

ANNOTATED LIST OF MINNESOTA CARICES,
WITH PHYTOGEOGRAPHICAL
AND ECOLOGICAL NOTES

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ABSTRACT

One hundred forty-two species of *Carex* are recorded for Minnesota, 4 of which have not been previously reported. Because four floristic provinces converge in Minnesota, certain groups of carices tend to be associated with specific geographic areas of the state. A map is presented that divides Minnesota into 9 areas of *Carex* affiliation, each of which is briefly discussed. Our carices also display other, more subtle and local, distributional patterns, and we demonstrate, through various examples, that many carices are greatly affected by the nature of the substrate in which they grow. Habitat descriptions for the 142 species are given in an annotated list, and for some carices additional taxonomic, phytogeographical and ecological comments are made. Distribution maps are presented, and for the 4 carices new to the state, representative collections are noted. Doubtful and excluded taxa are indicated and discussed.

Key Words: *Carex*, carices, sedges, Minnesota, floristic provinces, floristics, phytogeography, autecology

Since the late 1940's, the Moore and Tryon (1946) checklist of Minnesota plants has probably been the primary source of information used to ascertain what carices occur in the state. Because their *Carex* list is now greatly outdated and unfortunately contains some erroneous reports, we feel it highly desirable to provide an up-to-date account of the Minnesota *Carex* flora, an updating that should prove helpful to the numerous students of this genus both in Minnesota and in surrounding areas. We also comment here on the phytogeographical and ecological status of the genus in the state. Four carices previously unknown from Minnesota, *C. annectens*, *C. conjuncta*, *C. festucea*, and *C. laxiculmis*, are reported for the first time. Further, we suggest here that some carices reported for the state by Mackenzie (1931-1935) and later workers should be excluded.

NUMBERS OF SPECIES

Prior to Mackenzie's monograph of North American *Carex*, well over 100 species of the genus had been reported from Minnesota (Lapham, 1875; Upham, 1884, 1887; Arthur *et al.*, 1887; Bailey,

1892; MacMillan, 1892; Cheney, 1893; Sheldon, 1894, 1895, 1896; Holzinger, 1896; Wheeler, 1900, 1901; Rosendahl, 1903). Mackenzie recognized 116 species of *Carex* native to the state and deleted several previously reported taxa. Carices reported for Minnesota since Mackenzie's monumental work are given in Table 1.

Presently, 142 species of *Carex* are known to occur in Minnesota, and clearly they form the largest genus of vascular plants in the state. Except for *C. lurida*, one or more specimens of each of the species reported here are in the University of Minnesota Herbarium (MIN). A specimen of *C. lurida* (Sheldon, s.n., Milaca, Mille Lacs Co., July, 1892) is at the New York Botanical Garden (NY).

FLORISTICS

Gleason and Cronquist (1964) mapped three major floristic provinces (Grassland, Northern Conifer, Eastern Deciduous) as coming together within Minnesota. In Wisconsin, the Eastern Deciduous Province has been divided into the Northern Hardwoods Province to the north and the Prairie-Forest Province to the southwest (Curtis, 1959), and the boundary between the two, which Curtis (1959) refers to as the tension zone, meets the Minnesota border in northern Washington, Chisago, and southern Pine counties (Minnesota counties are shown in Figure 1). The geographical extension of this boundary zone across Minnesota is presently under study (Wheeler, G. A., E. J. Cushing, E. Gorham, G. B. Ownbey and T. Morley, in preparation). The approximate areas covered by the four floristic provinces in Minnesota are shown in Figure 2: Grassland in the west; Northern Conifer in the far north-central and northeastern portions; Northern Hardwoods in the north-central and east-central parts; and Prairie-Forest in central and southeastern Minnesota.

The diversity of floristic types in Minnesota is reflected in the large number of *Carex* species occurring in the state, especially when compared to the 68 species reported for North Dakota (McGregor *et al.*, 1977; Wheeler, 1983a), 74 for South Dakota (Van Bruggen, 1976), 106 for Iowa (Gilly, 1946; Hartley, 1966; McGregor *et al.*, 1977), and 124 for Manitoba (Scoggan, 1957). Some states and provinces in proximity to Minnesota, however, particularly those to the east, such as Michigan (Voss, 1972b) and Ontario (Scoggan, 1978), have appreciably larger *Carex* floras than ours.

Table 1. *Carex* Species Reported for Minnesota Since Mackenzie's (1931-1935) Monograph of North American Carices¹

<i>C. deflexa</i> (Lakela, 1941)
<i>C. debilis</i> (Lemon, 1943)
<i>C. crawei</i> (Lakela, 1944)
<i>C. angustior</i> (Moore and Tryon, 1946)
<i>C. capillaris</i> (Moore and Tryon, 1946)
<i>C. cephalantha</i> (Moore and Tryon, 1946)
<i>C. eleocharis</i> (Moore and Tryon, 1946)
<i>C. formosa</i> (Moore and Tryon, 1946)
<i>C. merritt-fernaldii</i> (Moore and Tryon, 1946)
<i>C. molesta</i> (Moore and Tryon, 1946)
<i>C. oligosperma</i> (Moore and Tryon, 1946)
<i>C. xerantica</i> (Fernald, 1950)
<i>C. filifolia</i> (Moore, 1950)
<i>C. obtusata</i> (Moore, 1950)
<i>C. katahdinensis</i> (Lakela, 1952)
<i>C. michauxiana</i> (Butters and Abbe, 1953)
<i>C. praticola</i> (Butters and Abbe, 1953)
<i>C. pallescens</i> (Lakela, 1954)
<i>C. woodii</i> (Hartley, 1966)
<i>C. hallii</i> (McGregor <i>et al.</i> , 1977)
<i>C. scirpiformis</i> (McGregor <i>et al.</i> , 1977)
<i>C. grayi</i> (Wheeler, 1979)
<i>C. typhina</i> (Wheeler, 1979)
<i>C. bromoides</i> (Wheeler, 1981b)
<i>C. gynandra</i> (Wheeler, 1981b)
<i>C. hitchcockiana</i> (Wheeler, 1981b)
<i>C. oligocarpa</i> (Wheeler, 1981b)
<i>C. garberi</i> (Wheeler, 1983b)
<i>C. annectens</i> (this report)
<i>C. conjuncta</i> (this report)
<i>C. festucacea</i> (this report)
<i>C. laxiculmis</i> (this report)

¹Only reports substantiated by annotated herbarium specimens are given here.

Because the four floristic provinces mentioned above converge in Minnesota, certain groups of carices tend to be associated with specific geographic areas of the state. Indeed, based on the distribution maps presented near the end of this report, the state can be divided into 9 areas of *Carex* affiliation (Figure 3). Each area is delimited by the presence of certain species restricted to it, or by the fact that widespread-occurring species are absent from it, or by both of these criteria. Some of these areas correspond closely to

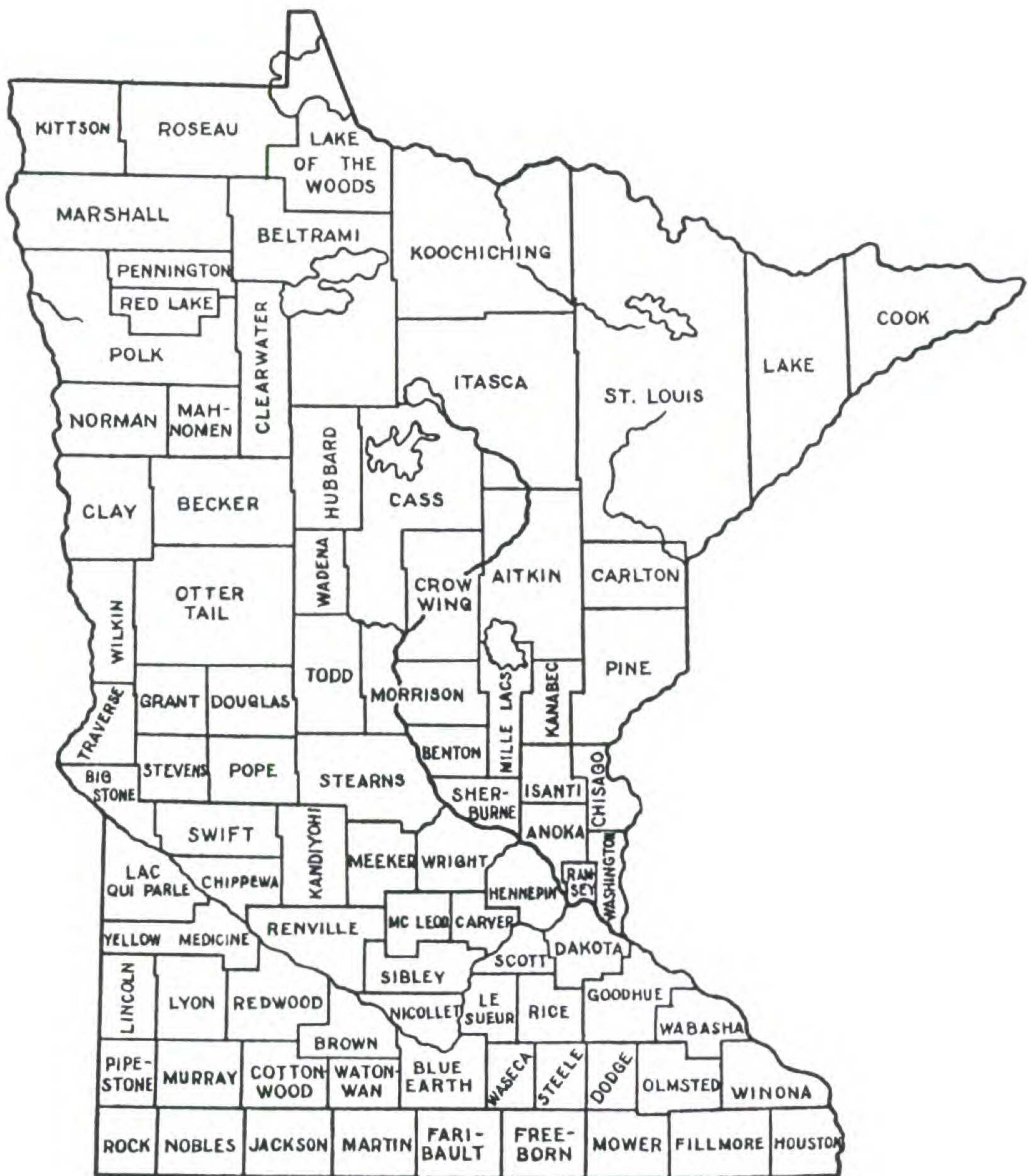


Figure 1. Counties of Minnesota.

landscape regions already defined for the state (Yaeger and Borchert, 1971; Wright, 1972).

Areas 1, 2, and 3 (Figure 3) harbor *Carex* taxa primarily associated with the Northern Conifer (e.g. *C. canescens*, *C. limosa*, and *C. pauciflora*) and Northern Hardwoods (e.g. *C. arctata*, *C. leptonevia*, and *C. ormostachya*) floristic provinces; areas 5, 6 and 7 harbor taxa primarily of the Prairie-Forest Province (e.g. *C.*

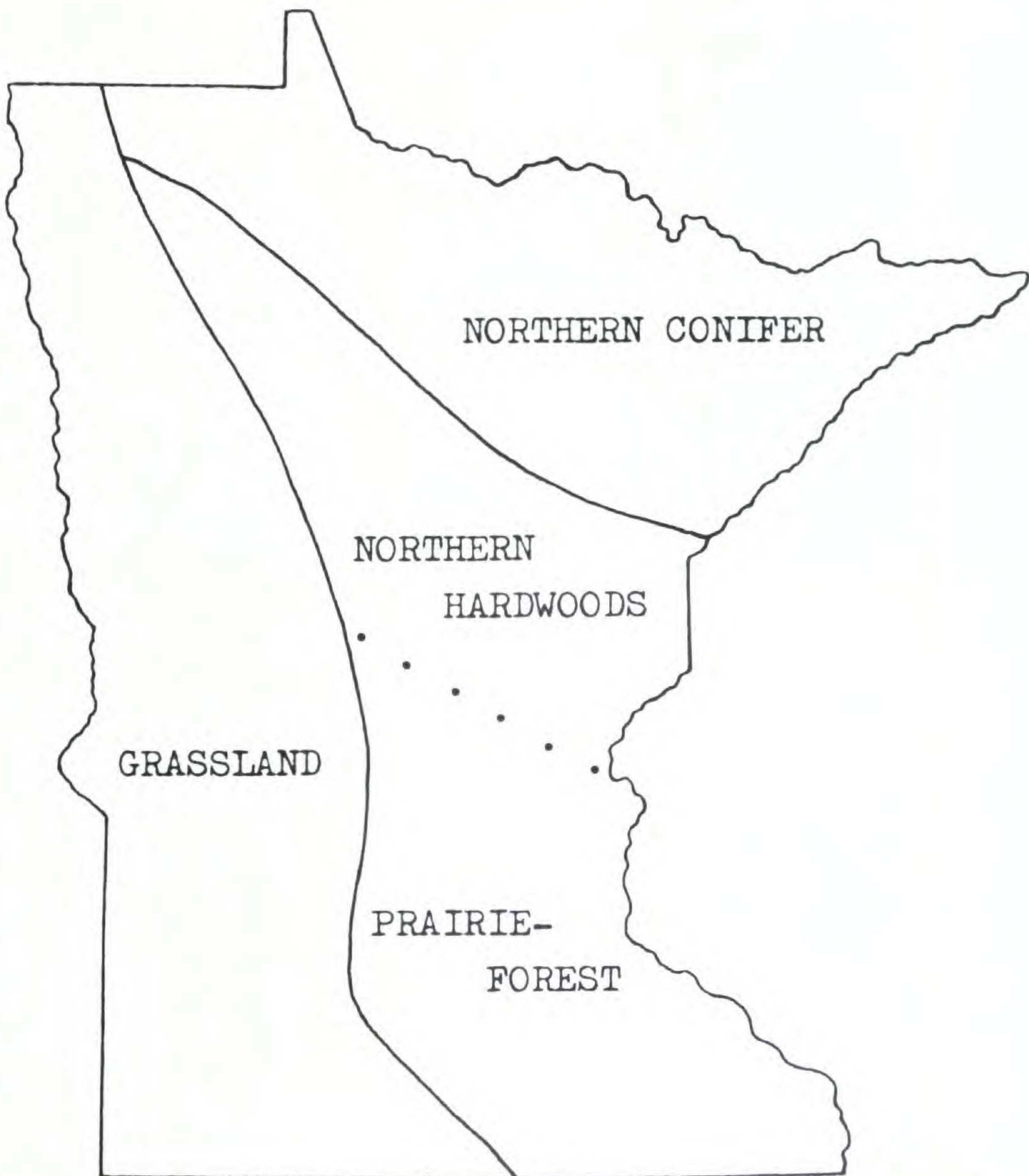


Figure 2. Floristic provinces in Minnesota, after Gleason and Cronquist (1964) and Cushing (1965). Dotted line shows approximate position of the floristic boundary that separates the Northern Hardwoods and Prairie-Forest floristic provinces in Minnesota (Cushing, 1965).

albursina, *C. cephaloidea*, and *C. sparganioides*); and areas 8 and 9 harbor taxa primarily of the Grassland Province (e.g. *C. eleocharis*, *C. hallii*, and *C. praegracilis*). Area 4 is characterized by an intermingling of carices from these four floristic provinces. The eastern extremity of area 4 corresponds closely to where the tension zone of Wisconsin (Curtis, 1959) meets the Minnesota border.

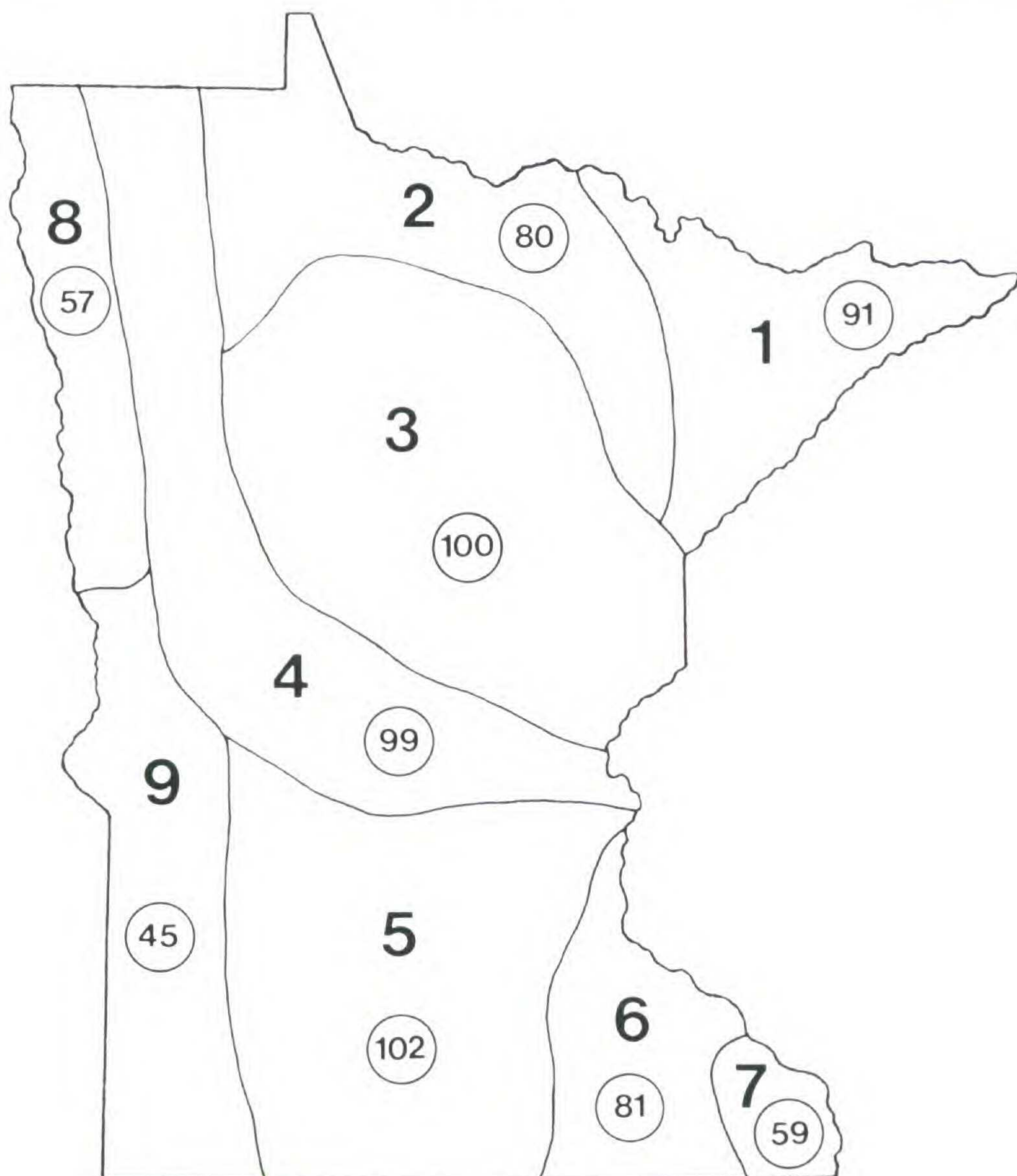


Figure 3. Areas of *Carex* affiliation in Minnesota. The number of carices known to occur within each area is circled.

Although the Northern Conifer and Northern Hardwoods floristic provinces are shown in Figure 2 as occupying geographically separate areas in the northern portion of Minnesota, it is clear that the vegetation of the region, or even a small part of it, cannot be characterized by a single species or group of only coniferous or deciduous species (Cushing, 1965). Instead, one finds here deciduous, pine, and boreal forest elements intermingling to create a mosaic of forest types. In consequence, many *Carex* species of northern affinity have state distributions that are relatively

similar, even though particular sets of species grow in clearly dissimilar habitats (Wheeler, 1983b). For instance, the distributions of *C. arctata*, *C. deflexa*, and *C. aenea* are somewhat similar, but the species frequent different habitats, namely deciduous, boreal, and pine forests, respectively. Owing to this intermingling of different forest types, much of northern Minnesota has been mapped (Küchler, 1964; Cushing, 1965) as mixed conifer-hardwood forest.

Area 1, which approximates the Ice Scoured North Shore region of Yaeger and Borchert (1971), is a land of lakes surrounded by high bluffs, deep gorges cut by swiftly moving streams, and rocky cliffs and shores that border on Lake Superior. This area is notorious for harboring plants of discontinuous range, particularly arctic-alpine species (Butters and Abbe, 1953; Given and Soper, 1981). Of the *Carex* species restricted (or nearly so) to area 1, some, such as *C. supina* and *C. xerantica*, are essentially confined to cliff-talus and bluff-tops bordering lakes near the Minnesota-Ontario border. *C. praticola* is also best known from bluff-tops in the Border Lakes region, but it also occurs, albeit rarely, on rocky sites farther southward. Three other carices with very restricted distributions in area 1 are *C. katahdinensis*, *C. michauxiana*, and *C. pallescens*; the first is known only from rocky shores of Iron Lake (St. Louis County), the second from swampy verges near Schroeder (Cook County), and the last from moist sites on the Lake Superior terrace near Duluth (St. Louis County). Of the remaining carices restricted to area 1, all of which occur more frequently than those just discussed, *C. lenticularis* and *C. media* are best known from the shores of Lake Superior, and *C. flava* and *C. gynandra* from springy sites and the marshy borders of streams and "bogs" just inland from the lake.

Issued as a caveat in a previous publication (Wheeler *et al.*, 1983), throughout this paper we use bog (the unadorned word) in the sense of true ombrotrophic conditions; we use "bog" (in quotes) in the sense of *Sphagnum*-dominated areas that typically have fen characteristics (e.g. peatland-surrounded kettle-hole lakes). Indeed, in Minnesota most kettle-hole "bogs" are actually poor fens and tamarack "bogs" (better termed swamps) often approach rich-fen conditions (Wheeler *et al.*, 1983). Only in the upland peatland areas in the far northern portion of the state are true ombrotrophic bogs encountered, such as in the large mire complex situated just north of Upper Red Lake.

Area 2, which is somewhat larger than the Big Bog region of Yaeger and Borchert (1971), is primarily an area of gentle slope and poor drainage that contains many upland peatlands. One of these, the Red Lake Peatland (Heinselman, 1963, 1970; Griffin, 1975, 1977; Wheeler and Glaser, 1979, 1982; Glaser *et al.*, 1981; Wheeler *et al.*, 1983), is the largest continuous mire in the contiguous United States. Many circumpolar species of *Carex* (Hultén, 1962), such as *C. canescens*, *C. chordorrhiza*, *C. diandra*, *C. disperma*, *C. lasiocarpa*, *C. limosa*, *C. pauciflora*, *C. paupercula*, *C. tenuiflora*, and *C. vaginata*, are widely distributed in northern Minnesota and several of them are most common and abundant in area 2. The latter is certainly true for the North American endemics *C. oligosperma* and *C. trisperma*, both of which commonly occur, and are sometimes dominants, in upland peatland.

Carices with restricted distributions in north-central Minnesota include *C. capillaris*, *C. exilis*, *C. garberi*, and *C. livida*. Of these, *C. exilis* and *C. livida* are primarily confined to scattered localities in areas 1 and 2, where they both frequent poor- and rich-fen sites in patterned peatlands (Glaser, 1983; Wheeler, 1983b). Of more restricted distribution, *C. capillaris* occurs only in the western portion of area 2 and small parts of 3 and 4, and *C. garberi* is known only from a single station in St. Louis County. Finally, some northern carices, such as *C. arcta* and *C. crinita*, are widely distributed in areas 1, 3, and 4 but are uncommon or unknown in area 2.

Areas 3, 4, and 5 harbor the greatest number of *Carex* species in the state (Figure 3), with area 4, as mentioned earlier, representing a transition zone. Nevertheless, several carices of northern affinity are known from isolated stations south of area 4, and some species of southern affinity north of it. Likewise, some western species, such as *C. torreyi*, occur at isolated stations east of this transition area. Carices known to be restricted (or nearly so) to one or more of these areas include *C. bromoides*, *C. debilis*, *C. festucacea*, *C. formosa*, *C. lurida*, and *C. rossii*. The four last-named species are known only from a few stations in Minnesota, and they seldom occur in abundance. *C. bromoides* and *C. debilis*, on the other hand, while being more or less restricted to the extreme east-central portion of the state, are both known from several localities and sometimes occur in great abundance. Indeed, *C. bromoides* often provides the major ground cover in low, swampy woodlands adjacent to rivers.

Wheeler (1981b) reported *C. bromoides* as extending no farther west in Minnesota than wooded lowlands bordering the Kettle River, but the authors have recently discovered several stations for this species along the Snake River (southern Aitkin and northern Kanabec counties), some 20 miles farther westward. Another *Carex* species growing in central Minnesota, *C. sterilis*, until recently had been known from very few localities in the state, but in the last few years several spring-fed, calcareous fens have been discovered in areas 4, 5, and 8 that harbor this apparent calciphile.

The Minnesota River, which flows primarily through the central portions of areas 5 and 9, presently occupies a small part of the huge valley cut out by the ancient River Warren. The river is bordered by bluffs that are not as imposing as those in extreme southeastern Minnesota, but these bluffs do harbor many plants that are uncommon or unknown elsewhere in these areas. *Carex hitchcockiana* and *C. oligocarpa* are best known in the state from these bluffs and, indeed, the latter provide the habitats for the northwesternmost stations for each of these species in North America (Wheeler, 1981b). Another sedge of frequent occurrence on these bluffs, particularly westward, is *C. saximontana*. Although this species is reported by various workers (Mackenzie, 1931–1935; Fernald, 1950; Gleason and Cronquist, 1963) as restricted in the state to “western Minnesota”, it does, in fact, extend as far eastward with us as Ramsey County, with the majority of the eastern stations situated on the bluffs of the Minnesota River.

Extreme southeastern Minnesota, the Stream Dissected region of Yaeger and Borchert (1971), is botanically as well as geologically one of the most interesting parts of the state. Area 7 is part of the celebrated Driftless Area (Hartley, 1966) and, like the remaining parts (in southwestern Wisconsin, northeastern Iowa, and northwestern Illinois), has very irregular topography resulting from the action of various natural processes, particularly stream erosion. Like the remainder of the Driftless Area, area 7 is notorious for harboring plants of limited or discontinuous range, such as *Montia chamissoi* (Portulacaceae), *Sullivantia renifolia* (Saxifragaceae), and *Talinum rugospermum* (Portulacaceae).

Several species of *Carex* occurring in southeastern Minnesota are unknown from elsewhere in the state, and include *C. annectens* (area 6), *C. conjuncta* (area 6), *C. crus-corvi* (area 6), *C. laevivaginata* (area 7), and *C. laxiculmis* (area 7). Furthermore, *C.*

davisii, *C. grayi*, *C. muskingumensis*, and *C. typhina* are primarily confined to the southeast, where they are characteristic species in floodplain forests, particularly those bordering the Mississippi River. Indeed, with the exception of *C. typhina*, which occurs at a few localities along the St. Croix River in Washington and southern Chisago counties, these species rarely occur north of Goodhue County (Wheeler, 1979). Finally, many *Carex* species occurring in area 5 and in areas farther north do not extend as far southeastward as area 6, and fewer yet extend into area 7 (Figure 3).

It is obvious from Figure 3 that fewer species of *Carex* occur in western Minnesota (areas 8 and 9) than in the eastern portion of the state. Although the genus is clearly less well represented in prairie than in forest, fen, or "bog", individual species, such as *C. brevior* and *C. eleocharis* in dry sites and *C. atherodes* and *C. praegracilis* in wet sites, are sometimes widespread and abundant in undisturbed prairie. Indeed, *C. eleocharis* sometimes forms, along with various grasses, the major ground cover on hillsides and slopes, and *C. atherodes* is often the dominant species in prairie swales. In Minnesota, as well as elsewhere (Hudson, 1977), *C. atherodes* appears to tolerate the drying up of prairie swales, unlike *C. lacustris*, *C. rostrata*, and *C. aquatilis*, which seem to need more or less persistently wet conditions. Therefore, only at very favored locations within the prairie region of Minnesota are the last three species able to attain dominance. Some prairie carices, including *C. hallii*, *C. scirpiformis*, *C. filifolia*, and *C. obtusata*, have very restricted distributions in the western half of the state, and they seldom occur in any great abundance. The first two species seem to be restricted to prairie swales, particularly to the moist outer margins, and the last two taxa grow primarily in dry, sandy sites, such as in sand barrens. A paper discussing all 9 areas in more detail is being prepared.

Although a particular *Carex* species may be common in one region of Minnesota, it may also occur, as indicated above, at isolated stations in other parts of the state. For instance, several carices that have their major occurrence in *Sphagnum*-dominated areas in northern Minnesota, such as *C. canescens*, *C. leptalea*, and *C. paupercula*, also occur in tamarack "bogs" scattered throughout the central and, less commonly, the southern portions of the state. Furthermore, some calcareous fens in southern and western Minnesota harbor some carices of northern affinity, such as *C. aquatilis*, *C. lasiocarpa*, and *C. limosa*.

While many species of *Carex* are geographically restricted in the state, others are more widely distributed. A number of the latter, such as *C. hystericina*, *C. lanuginosa*, *C. stipata*, *C. stricta*, and *C. vulpinoidea*, are aquatic plants (Fassett, 1957) that grow along shores and in adjacent wet meadows of the numerous lakes scattered throughout Minnesota. Some woodland species, such as *C. peckii*, *C. pedunculata*, *C. pennsylvanica*, and *C. rosea*, are also widely distributed. And some carices that grow along the banks of rivers often have wide distributions in the state. However, some riverine carices, such as *C. alopecoidea*, *C. cristatella*, and *C. emoryi*, are essentially absent from extreme northeastern Minnesota, an area where prolonged level riparian tracts with well-developed meander scrolls and floodplains are mostly lacking because the rivers flow swiftly from the upland down a steep gradient to Lake Superior (Wheeler, 1983b).

As in the above case, the distributions of other sedges in the state are restricted by the lack of suitable habitats. For example, several carices, including *C. atherodes*, *C. interior*, *C. praegracilis*, *C. prairea*, *C. sartwellii*, and *C. tetanica*, all of which grow primarily in prairie swales and marshlands, have state distributions that approximate that of the calcareous drift deposited by the Mankato Substage of the Wisconsin Stage of glaciation. It appears that a lack of low, wet, strongly calcareous habitats in southeastern Minnesota results in the exclusion (or near exclusion) of these species from this part of the state, an area not invaded by the Des Moines Lobe of the Mankato Substage. Several other vascular species that frequent wet calcareous sites, such as *Juncus balticus* (Juncaceae), *Rumex maritimus* (Polygonaceae), *Iris versicolor* (Iridaceae), and *Habenaria hyperborea* (Orchidaceae), are also essentially absent from the southeast. In Figure 3, this demarcation is illustrated by the line that separates area 5 (covered with Des Moines calcareous drift) and area 6 (not covered with Des Moines calcareous drift).

Because four floristic provinces converge in Minnesota, many species of *Carex* reach the limits of their ranges in the state (Wheeler, 1981a). Some of these carices, such as *C. brunnescens* (Northern Conifer Province), *C. leptonevia* (Northern Hardwoods Province), *C. hirtifolia* (Prairie-Forest Province), and *C. filifolia* (Grassland Province), display more or less continuous ranges as they approach and enter Minnesota. Other carices, however, are represented by only a few local populations in the Midwest. As an example of the latter, *C. exilis* is primarily a plant of the Atlantic

coastal plain that has only limited local populations west of New York (Reznicek and Ball, 1980). In Minnesota, it is known only from a few patterned peatlands in the northeastern and north-central portions of the state (Glaser, 1983; Wheeler, 1983b), with the Red Lake Peatland harboring the westernmost stations in North America (Wheeler and Glaser, 1979; Wheeler *et al.*, 1983).

Lastly, a few *Carex* taxa, such as *C. supina*, represented in the state by disjunct populations, may be relicts. However, their migration to favorable habitats after glaciation cannot be ruled out. The relict hypothesis is generally favored to explain the wide discontinuities in range of arctic-alpine taxa in the Lake Superior region (Butters and Abbe, 1953; Soper and Maycock, 1963; Given and Soper, 1981) and is supported by some palynological data (Cushing, 1965). The nunatak hypothesis of Fernald (1935) is no longer considered tenable (Cushing, 1965). Probable *Carex* relicts occurring in Minnesota are indicated and discussed in the listing of species given near the end of this report.

Besides the distributions discernible for Minnesota *Carex* species resulting from the convergence of the four floristic provinces within the state, our carices display still other more subtle and local distributional patterns. Many carices are greatly affected by the nature of the water in which they grow (Wheeler *et al.*, 1983), which in turn is influenced by the physical nature of the water source. That some peatland *Carex* species are profoundly acidophilous or basiphilous is well known (e.g. Sjörs, 1961, 1963), and this fact has been demonstrated for some carices occurring in kettle-hole "bogs" and upland peatland areas in northern Minnesota (Glaser *et al.*, 1981; Wheeler *et al.*, 1983).

Carex species primarily confined to *Sphagnum*-dominated areas in Minnesota have state distributions that are somewhat similar, but some differences are apparent. For example, *C. oligosperma* and *C. pauciflora* are occasional to common in peatlands and "bogs" throughout the northeastern, north-central, and east-central portions of the state, but they are essentially absent from such habitats in the central, west-central, and northwestern parts of Minnesota. In contrast, many other "bog-loving" carices, such as *C. lasiocarpa*, *C. leptalea*, and *C. limosa*, are present in these habitats throughout the entire northern half of the state and, as indicated earlier, some of them extend even farther southward and westward, growing in fens and tamarack swamps. Significantly, other vascular "bog-loving"

species display similar distributional patterns: *Eriophorum spissum* (Cyperaceae), *E. virginicum*, and *Kalmia polifolia* (Ericaceae) have distributions in the state similar to those of *C. oligosperma* and *C. pauciflora*, whereas many other species, such as *Betula pumila* (Betulaceae), *Equisetum fluviatile* (Equisetaceae), and *Menyanthes trifoliata* (Gentianaceae), have state distributions similar to *C. lasiocarpa*, *C. leptalea*, and *C. limosa*. Because some oligotrophic species, particularly obligate oligotrophs, are probably unable to achieve ecesis in highly nutrient-rich conditions, the moderately to highly minerotrophic nature of the fens and “bogs” in western and southern Minnesota may well impede the growth of such species. Indeed, *C. oligosperma* and *C. pauciflora*, as well as the other three vascular plants mentioned above with restricted distributions in Minnesota, are essentially confined to oligotrophic sites in the Red Lake Peatland (Wheeler *et al.*, 1983), and they are more or less restricted to kettle-hole “bogs” in the state that are “acidic” (pH usually less than 6.5).

In the Red Lake Peatland, which is situated just north of Upper Red Lake in north-central Minnesota, *Carex* species account for approximately 15% of the vascular flora (Wheeler *et al.*, 1983). In this mire, ombrotrophic bogs, areas of weak minerotrophy (poor fens), and patterned rich fens can be distinguished on the basis of acidity and other chemical properties of the peat and surface-waters and by species richness. Only four *Carex* species (*C. oligosperma*, *C. pauciflora*, *C. paupercula*, and *C. trisperma*) are known from ombrotrophic sites in the mire, whereas twenty-nine carices frequent minerotrophic sites. Some species, such as *C. chordorrhiza* and *C. livida*, are excellent indicators of minerotrophy, inasmuch as they separate areas of weak minerotrophy from true ombrotrophic sites. Still other species, such as *C. leptalea* and *C. pseudocyperus*, are obligate rich-fen indicators. However, in the Red Lake Peatland, as in other mires (e.g. Malmer, 1962; Sjörs, 1963), there are no vascular taxa, including *Carex*, that are indicators of ombrotrophy.

In upland peatlands, variations in environmental parameters such as in water chemistry, hydrology and shading greatly influence whether a particular species will be present or absent from a particular site. Figures 4 and 5 illustrate for four *Carex* species common to the Red Lake Peatland the relationship between the principal components axes, which are based on variations in the frequency with which species occur, and environmental factors

(Brush, 1982). These figures show that whereas *C. oligosperma* displays a narrow range of tolerance for all environmental parameters considered, each of the other three species displays a relatively wide range of tolerance for one or more of these parameters. Although Figures 4 and 5 were constructed from data gathered from one mire complex, the results (for these four species) seem to hold in other upland peatlands investigated in the state.

Although *C. oligosperma* dominates large areas in the Red Lake Peatland, it is more or less restricted to open bogs and bog drains, and to meadow-like, open poor-fen areas where bog drains coalesce. In contrast, *C. lasiocarpa* grows over a wide range of pH and calcium values, and it is often the dominant species in wet, open rich-fen sites, such as flarks of patterned fens. With regard to the other two peatland species referred to in Figures 4 and 5, *C. trisperma* is restricted to wooded bogs, wooded poor-fen islands, and hummock-tops in the wooded rich-fen islands. *C. leptalea*, on the other hand, is an obligate rich-fen indicator that grows most abundantly on wooded rich-fen islands but also occurs in flarks and in partially-shaded depressions between string hummocks in patterned fens. A more detailed discussion of the distribution of *Carex* species along various environmental gradients in the Red Lake Peatland is given by Wheeler *et al.* (1983).

Another example of species of *Carex* being affected by differences in water chemistry can be demonstrated from kettle-hole "bogs". In east-central, north-central, and northeastern Minnesota, *Carex oligosperma* is almost invariably the most important species in the formation of pioneer mats surrounding "acid" kettle-hole lakes (actually most such lakes are weakly acid, with a pH usually less than 6.5), as well as being the dominant vascular plant in adjacent moss-heath zones. It is replaced by *C. lasiocarpa*, however, in kettle-hole "bogs" surrounding "alkaline" lakes (pH mostly greater than 6.5). Indeed, throughout these areas the two species seldom grow together on the same floating mats or in the same "bogs," but *C. lasiocarpa* sometimes frequents the nutrient-rich laggs of *C. oligosperma*-dominated peatlands. Some species of *Carex* are common to both types of *Sphagnum*-dominated peatlands, whereas others are restricted to one type or the other. Species commonly found on mats and "bogs" dominated by *C. oligosperma* are *C. pauciflora*, *C. paupercula*, *C. limosa*, *C. canescens*, and *C.*

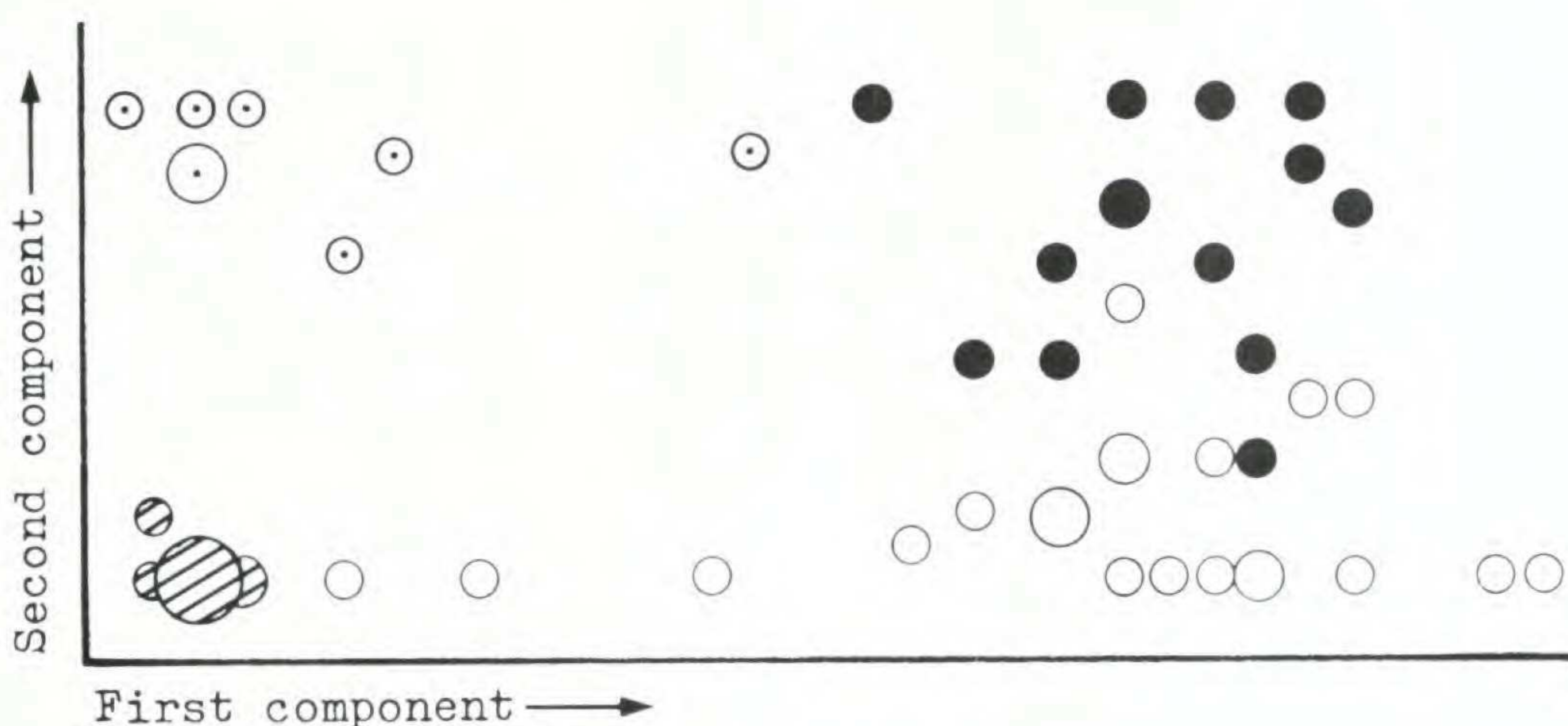


Figure 4. Local environmental interactions on distribution of 4 *Carex* species. The first component shows a distribution ranging from "acid" species at the left to "circumneutral" species at the right; pH values range from 3.8 to 7. The second component reflects tolerance to shading, with sciaphytes appearing on the top of the axis and heliophytes on the bottom. The sizes of the circles are proportional to the number of occurrences of a particular species in 45 relevés (Wheeler *et al.*, 1983); the largest circle represents 4 occurrences and the smallest circle a single occurrence. The circles with diagonal lines represent *C. oligosperma*; dotted circles *C. trisperma*; open circles *C. lasiocarpa*; and closed circles *C. leptalea*.

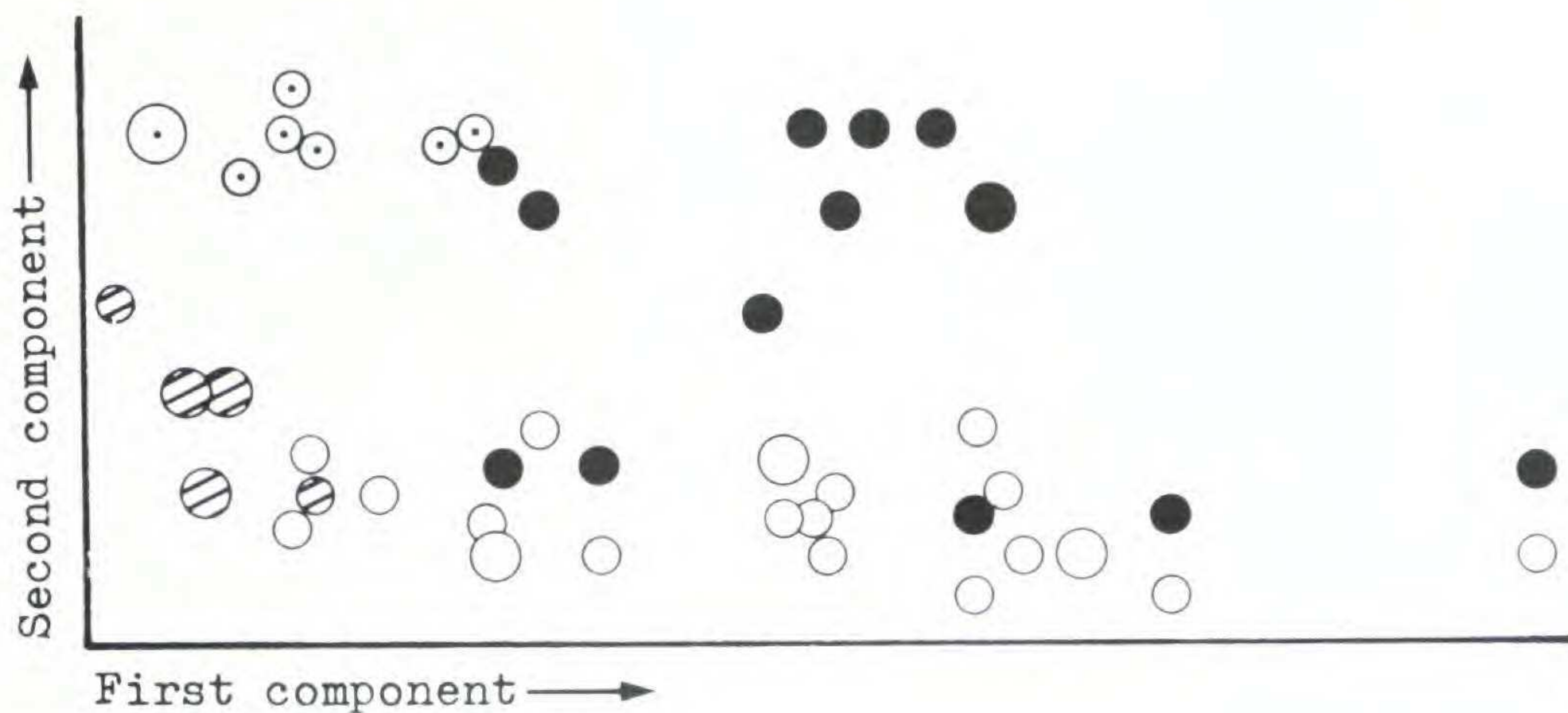


Figure 5. Local environmental interactions on 4 *Carex* species. The first component shows a distribution ranging from calciphobic species (left on the axis) to calciphilic species (right on the axis); calcium values range from 0.5 mg/l to 19.6 mg/l. The second component reflects tolerance to dry sites, with "dry" species appearing on the top of the axis and "wet" species on the bottom. See Figure 4 for explanation of symbols and circle sizes.

chordorrhiza; species occurring most often on mats and in "bogs" dominated by *C. lasiocarpa* are *C. aquatilis*, *C. diandra*, *C. limosa*, *C. canescens*, *C. chordorrhiza* and, more rarely, *C. paupercula*. Likewise, in northern Michigan (Vitt and Slack, 1975), the *Carex* species of peatlands surrounding acid kettle-hole lakes are mostly different from those in peatlands surrounding alkaline lakes.

Several instances are known from Minnesota where a particular terrestrial species of *Carex* is restricted to a specific soil type and is absent from others. For example, *C. backii* grows in sandy, acid soils whereas *C. albursina*, *C. hitchcockiana*, *C. laxiculmis*, and *C. oligocarpa* grow in calcareous sites. The four last-named species, all of which are confined to the southern half of the state, are well known from sugar maple-basswood forests that are situated on steep, north- and east-facing slopes characterized by rich loamy soils. These calciphiles or near-calciphiles (Mackenzie, 1931-1935; Hermann, 1940; Fernald, 1950; Wheeler, 1981b) are absent from neighboring dry hardwood forests and the more locally occurring woodlands dominated by white pine, both of which are developed on better-drained, more acid, sandy soils. In contrast, the acidophilous species *C. backii*, although best known from pine forests in northern Minnesota, is of occasional occurrence in the aforementioned white pine-dominated woodlands but is rare or absent from the neighboring, much more common, sugar maple-basswood forests. Other examples of distributional patterns exhibited by *Carex* species in Minnesota are given by Wheeler (1981a).

Quite often the same combination of carices grow in a particular habitat even though the localities are miles apart, and at least in some habitats, if not in most, certain species are associated with specific microhabitats. For example, in a recent study of 17 tamarack swamps in seven counties in west-central and northwestern Minnesota, of the 15 carices found growing in these swamps, 10 species (*C. aurea*, *C. paupercula*, *C. retrorsa*, *C. stipata*, *C. deweyana*, *C. disperma*, *C. hystericina*, *C. interior*, *C. leptalea*, and *C. pedunculata*) were present in at least 75% of the swamps investigated; and the 6 last-named species were present in over 85%. Of the remaining species, 4 of them, *C. brunnescens*, *C. gynocrates*, *C. rosea*, and *C. tenuiflora*, occurred in more than one swamp, and *C. vaginata* was limited to a single swamp in Mahnomen County. Furthermore, one or more *Carex* species, such as *C. atherodes*, *C. lacustris*, *C. stricta* or, less commonly, *C. lasiocarpa*, *C. prairea*, and

C. rostrata, invariably grow along the margins of these swamps and sometimes in the swamp interiors.

Within these tamarack swamps, *C. disperma*, *C. leptalea*, and *C. deweyana* are primarily associated with the sides and tops of hummocks, whereas *C. aurea*, *C. interior*, and *C. paupercula* generally grow in wet depressions between hummocks. *C. pedunculata* is mostly confined to the bases of trees and windthrow mounds, and *C. hystericina*, *C. retrorsa*, and *C. stipata* are most abundant and grow best in low, level areas. *C. lacustris* often dominates the outer edges of the swamps, sometimes growing in nearly pure stands, and is often a common constituent in the interiors, particularly in and around the margins of small pools and other wet depressions.

Some *Carex* species have clearly expanded their ranges within rather recent times through man's intervention. In Minnesota, probably the most obvious example is *C. praegracilis* which, although native in western and south-central Minnesota, is now adventive in the north-central, northeastern, and extreme east-central portions of the state, particularly along highway verges (Wheeler, 1983b). This species has, in fact, become adventive well eastward of its native range (Mackenzie, 1931-1935; Hermann, 1974; Reznicek *et al.*, 1976), presumably through dispersal of achenes and rhizomes along major highways and because of its apparent high resistance to extreme conditions of road verges, such as summer drought and high sodium levels owing to "de-icing" salt (Reznicek *et al.*, 1976).

Another example of area expansion of *Carex* species within the state can be demonstrated from the Red Lake Peatland. Although twenty-nine carices are known from this mire, nine of them are clearly restricted to disturbed sites. It is assumed that these species have only recently entered the mire, most likely following the construction of the major highway that transects the area and the several drainage ditches that penetrate into the peatland interior. Although these species are most likely recent arrivals, they presently form an integral part of the peatland flora and no doubt will continue to spread to future disturbed areas (Wheeler *et al.*, 1983).

Hybridization is known to occur in *Carex* (Wahl, 1940; Drury, 1956), and several hybrids and suggested hybrids have been reported from the eastern United States and Canada (Fernald, 1950; Scoggan, 1978). Although little is known about the hybridization of

Carex in Minnesota, observations in the field and some herbarium specimens suggest that crossing does take place between particular species in the state. Specimens have been seen from southeastern Minnesota (Houston and Winona counties) that appear to be hybrids of *C. tenera* and *C. normalis*. Hybridization between these two members of the *Ovales* group is not indicated by Fernald (1950) or Scoggan (1978), but it has been reported by Zimmerman (1976) as possibly occurring in Wisconsin.

Specimens which display characteristics intermediate between *Carex bebbii* and *C. cristatella* (both members of the *Ovales* group) are also known from the state; these specimens come from northern Minnesota (Lake of the Woods, Itasca, and St. Louis counties). Hybridization between *C. bebbii* and *C. cristatella* has been reported as possibly occurring in Michigan (Voss, 1972b), Wisconsin (Zimmerman, 1976), and Saskatchewan (Hudson, 1977), but it was not indicated by Fernald (1950) or Scoggan (1978).

A plant which closely resembles *Carex castanea*, but which is more glabrous, is known from widely scattered localities in the United States and Canada (Arthur *et al.*, 1887; Bill, 1930; Mackenzie, 1931–1935; Fernald, 1950; Scoggan, 1978), and it is considered by some workers (Fernald, 1950; Scoggan, 1978) to be a hybrid between *C. castanea* and *C. arctata* (both members of the *Sylvaticae* group). In Minnesota, this suspected hybrid (*C. ×knieskernii* Dew.) is known only from St. Louis County. Specimens of suspected hybrids have not been mapped for this study.

The species listed below are arranged alphabetically, and for the most part the treatment here follows that of Mackenzie (1931–1935), except where a departure has been forced (or at least suggested) by certain available evidence. Section or group (see Voss, 1966, 1972a, 1972b) relationships are indicated, and synonyms correlating this treatment with those in current manuals are noted. Although group names are without formal taxonomic standing, the group that includes the type species of the genus, *C. hirta*, is here called *Carex* in accord with the spirit of the Code of Nomenclature.

Data gathered from field observations and specimens contained in various herbaria (DUL, GH, IA, ISC, MANK, MICH, MIN, NDA, NY, SCL, US, UWL, WIS; abbreviations after Holmgren *et al.*, 1981) were used to develop habitat descriptions. The areas illustrated in Figure 3 are referred to when they are useful in

characterizing distribution patterns and when reporting the frequency of occurrence of a species within a particular area.

On the distribution maps, which were prepared from the herbarium specimens examined, each solid circle represents a collection of known locality; an open circle represents a collection without specific location within a county.

Following the annotated list are remarks on some doubtful and excluded taxa.

ANNOTATED LIST OF MINNESOTA CARICES

C. abdita Bickn.

Montanae

Cliffs and bluffs, rocky slopes and shores, rock outcrops and, more rarely, dry prairies; infrequent to occasional in the eastern half of the state, uncommon in the western half. Some authors (e.g. Gleason and Cronquist, 1963) combine *C. abdita*, *C. tonsa*, and *C. umbellata* under the epithet *umbellata*, but in Minnesota the first-named entity is well-marked and easily distinguished from the other two: beak of perigynium is short and the tips of the pistillate scales are acute. In contrast, the other two entities have long beaks and acuminate scales. Furthermore, whereas *C. tonsa* and *C. umbellata* generally grow in sand barrens and in other sandy sites, some of which are highly disturbed, *C. abdita* rarely grows in pure sand, and particularly not in disturbed places; instead, it seems to be invariably associated with rocky slopes, rock outcrops, and cliffs and bluffs. For those (e.g. Mackenzie, 1931–1935, 1940; Voss, 1972b) who consider *C. rugosperma* Mack. to be the true *C. umbellata* Schkuhr ex Willd., then this entity becomes *C. umbellata* Willd. See comments under *C. tonsa* and *C. umbellata*.

C. adusta Boott

Ovales

Rock outcrops, cliffs and bluffs, margins of pine forests, sandy and rocky slopes, and sandy disturbed sites (sand and gravel pits, roadside shoulders and embankments, clear-cut and burned-over areas); frequent in area 1, infrequent to occasional in 2, 3.

C. aenea Fern.

Ovales

Sandy and rocky slopes, margins of pine forests and pioneer hardwood stands, cliffs and bluffs, and sandy disturbed sites (sand and gravel pits, roadside shoulders and embankments, clear-cut and burned-over areas); frequent to common in area 1, occasional in 2, 3.

C. albursina Sheldon*Laxiflorae*

Steep hardwood-covered slopes, moist wooded ravines and, less commonly, flat deciduous woodlands; occasional to frequent in area 7, infrequent to occasional in 5, 6. The type of this species was collected near White Bear Lake (Washington County) in east-central Minnesota by E. P. Sheldon in 1892. Some workers (e.g. Gleason and Cronquist, 1963) treat it as *C. laxiflora* Lam. var. *latifolia* Boott.

C. alopecoidea Tuckerm.*Vulpinae*

Floodplain forests, abandoned river channels and ox-bows, woodland swales and pond margins, wooded river banks, ditches, and moist to wet meadows adjacent to rivers and creeks; occasional throughout the state, except in area 1, where it is unknown.

C. amphibola Steud.*Griseae*

Floodplain forests, mesic hardwood stands (especially in swales and along the margins of creeks and ponds), wooded river banks, and disturbed sites (trails and paths); frequent to common in areas 5, 6, 7, occasional in the eastern half of 4, infrequent in 9, uncommon in 3. Our material may be referred to var. **turgida** Fern. [*C. grisea* Wahlenb.; *C. turgida* (Fern.) J. W. Moore].

C. angustior Mack.*Stellulatae*

Wet sandy shores of lakes, margins of alder swamps, wet edges of trails, and "bog" borders; occasional in area 1, infrequent in 2, 3. *C. angustior* and *C. cephalantha* are fairly distinctive in Minnesota and, as such, they are treated here as separate species. It must be noted, however, that Reznicek and Ball (1980), in their recent treatment of the *Stellulatae* group, place both of these entities under *C. echinata* Murr. Previously, some workers (e.g. Gleason and Cronquist, 1963) treated *C. angustior* and *C. cephalantha* as varieties of *C. muricata* L., as var. *angustata* Carey and var. *cephalantha* Baily, respectively. In Minnesota, *C. cephalantha* grows in "bogs" and in upland peatlands whereas *C. angustior* grows primarily in wet depressions along the edges of swamps and trails as well as along the wet shores of lakes. In the Red Lake Peatland, *C. cephalantha* is a frequently-occurring plant on strings of patterned fens, but *C. angustior* is absent from this large mire complex. A similar situation, as regards the presence of *C. cephalantha* and absence of *C. angustior*, seems to exist in the other

upland peatlands that have been recently investigated in the state. *C. cephalantha*, on the other hand, seems to be invariably absent from those habitats given for *C. angustior*. For the majority of our material, the morphological differences usually given to separate these two entities (e.g. Fernald, 1950) seem to hold quite well.

C. annectens (Bickn.) Bickn.

Multiflorae

Two stations are known for this species in Minnesota. It was first collected on sand barrens at the Weaver Dunes (Wabasha County), where it was primarily associated with *C. muhlenbergii*. Only a few clumps were observed, all growing in proximity to one another. Somewhat later, the species was collected on a mesic prairie strip in Mower County. While the latter material is var. *xanthocarpa* (Bickn.) Wieg., the former material is probably best treated as var. *annectens*. This note represents the first report of this species from Minnesota; it appears to be very rare in the state.

Mower Co.: 3 mi. NW of LeRoy on Rte. 56, mesic prairie strip, T101N, R14W, Sec. 19, *Smith 4348* (MIN). Wabasha Co.: 5 mi. SE of Kellogg on Rte. 84, sand dune area, T109N, R9W, Sec. 5, *Wheeler 2700* (MIN).

C. aquatilis Wahlenb.

Acutae

Most Minnesota material is var. **altior** (Rydb.) Fern., which frequents marshy lake shores, floating peat mats surrounding alkaline kettle-hole lakes, "bog" borders, swales that are persistently wet, ditches, and the margins of streams; occasional to frequent in the northern half of the state, infrequent in the southern half. The var. **aquatilis**, which was reported for Minnesota by Butters and Abbe (1953), is known only from the extreme northeast corner of the state, where it is uncommon. These two taxa have not been mapped separately.

C. arcta Boott

Heleonastes

Floodplain forests, abandoned river channels and ox-bows, woodland swales and pond margins, mixed conifer-hardwood swamps, and "bog" borders; occasional in areas 1, 3.

C. arctata Boott

Sylvaticae

Mesic to dry forests (deciduous, mixed conifer-hardwood and, less commonly, coniferous), thickets, clearings, and wooded river banks; frequent to common in areas 1, 2, 3, infrequent in 4, uncommon in 5.

C. assiniboinensis W. Boott*Sylvaticae*

Floodplain forests, abandoned river channels and ox-bows and, less commonly, mixed conifer-hardwood forests and mesic hardwood stands; occasional to frequent throughout the state, except in the northeast and southeast corners, where it is rare or unknown. The plants often bear numerous, long-arching sterile culms or stolons, the tips of which upon reaching the ground form new plants; at some localities these sterile culms form the major cover of the field layer. Various workers (Tolstead, 1946; Stevens, 1950; Bernard, 1959; Hudson, 1977; Wheeler, 1981a, 1983b) have discussed or alluded to vegetative reproduction in this species.

C. atherodes Spreng.*Paludosae*

Prairie swales, wet meadows, ditches, and the marshy borders of lakes, rivers, and ponds; frequent throughout the state, except in the northeast and southeast corners, where it is rare or unknown. The plants often form dense, nearly pure stands in swales and other wet depressions, even those that dry up during the summer. Easily recognized by the pubescence on the sheaths and underside of the leaves, but plants growing in standing water sometimes lack this pubescence.

C. aurea Nutt.*Bicolores*

Moist to wet meadows, damp sandy shores, ditches, swampy woods, marshy borders of lakes and springy banks of streams, and disturbed sites that are artificially watered (e.g. taconite tailings ponds); frequent in the northern half of the state, infrequent to occasional in the southern half. The perigynia are brightly colored (golden-yellow or brownish-orange) and fleshy at maturity, and in all probability attract birds. See comments under *C. garberi*.

C. backii Boott*Phyllostachyae*

Wooded slopes, cliffs and bluffs, ravines, and sandy ridges in pine stands; occasional in the eastern half of the state, infrequent in the western half. See comments under *C. saximontana*.

C. bebbii (Bailey) Fern.*Ovales*

Moist meadows, swales, ditches, clearings, and the marshy margins of lakes, rivers, and ponds; occasional to frequent throughout the state, except in the southwest, where it is uncommon. This species rarely occurs in woodlands, and it has been

suggested (Hudson, 1977) that its rarity in prairies is because of an intolerance to soluble salts.

C. bicknellii Britt.

Ovales

Prairies, sandy hillsides, railroad and highway embankments (especially prairie strips), sand barrens, rock outcrops, and, less commonly, the borders of lakes and ponds; occasional to frequent in the southern half of the state, infrequent in the northern half.

C. blanda Dew.

Laxiflorae

Deciduous woodlands of all types and disturbed sites (e.g. clearings, paths and trails, roadway embankments); common in areas 5, 6, 7, occasional to frequent in 4, 8, 9, infrequent in 3. One of the most commonly-occurring carices in deciduous woodlands in the southern half of the state. Some workers (e.g. Gleason and Cronquist, 1963) treat it as *C. laxiflora* Lam. var. *blanda* (Dew.) Boott. See comments under *C. leptoneuria*.

C. brevior (Dew.) Mack.

Ovales

Prairies, sandy hillsides, railroad and highway embankments (especially prairie strips), sand barrens, rock outcrops, sandy disturbed sites and, less commonly, cliffs and bluffs, river banks, and open woodlands; frequent to common in the western and southern portions of the state, infrequent in the north-central and northeastern portions. One of the most commonly-occurring carices in dry, open sites in southern and western Minnesota.

C. bromoides Willd.

Deweyanae

Floodplain forests, abandoned river channels and ox-bows, woodland swales and pond margins, mixed conifer-hardwood swamps, and the springy banks of streams; restricted to east-central Minnesota, where it is locally abundant. Best known from low, swampy woodlands along the Kettle (Wheeler, 1981b) and Snake rivers.

C. brunnescens (Pers.) Poir.

Heleonastes

Coniferous and mixed conifer-hardwood forests and swamps, alder swamps, clearings, and "bog" borders; frequent to common in areas 1, 2, 3, occasional in 4, uncommon in 5, 8. Our material may be referred to var. **sphaerostachya** (Tuckerm.) Kükenth.

C. buxbaumii Wahlenb.*Atratae*

Moist meadows, prairie swales, fens (usually confined to flarks in patterned fens), rocky shores of lakes, and wet ditches; occasional to frequent in the northern half of the state, infrequent to occasional in the southern half (except in the southwest, where it is unknown). In the Red Lake Peatland, it is infrequent in flarks of patterned fens and in disturbed sites (Wheeler *et al.*, 1983).

C. canescens L.*Heleonastes*

Open and wooded oligotrophic and mesotrophic "bogs", floating peat mats surrounding acid and alkaline kettle-hole lakes, fens (usually associated with strings in patterned fens) and, somewhat less commonly, conifer and mixed conifer-hardwood swamps, and alder swamps; frequent in areas 1, 2, 3, occasional in 4, uncommon in 5. In areas 4 and 5, it is mostly restricted to tamarack swamps. In the Red Lake Peatland, it grows in wet hollows on the poor- and rich-fen wooded islands, along the margins of string hummocks in patterned fens, and in disturbed sites (Wheeler *et al.*, 1983). Most of our material may be referred to var. **disjuncta** Fern., but var. **subloliacea** (Laest.) Hartman also occurs occasionally. Furthermore, some material from the extreme northeast is best referred to typical var. **canescens**. But because intergrades are so frequent, particularly between the first two taxa, these three entities have not been mapped separately.

C. capillaris L.*Capillares*

Moist shaded lake shores and, less commonly, thickets, wooded beach ridges, and "bog" and swamp borders; infrequent to occasional in the western portions of areas 2, 3, uncommon in 4. Best known from the environs of Lake Itasca (Clearwater County). Our material may be referred to var. **major** Drej. [*C. capillaris* var. *elongata* Olney; *C. capillaris* ssp. *chlorostachys* (Stev.) Löve, Löve, & Raymond].

C. castanea Wahlenb.*Sylvaticae*

Mesic meadows, abandoned fields, "bog" and swamp borders, lake shores, roadside embankments, and ditches; occasional in areas 1, 2, 3.

C. cephalantha (Bailey) Bickn.*Stellulatae*

Open mesotrophic "bogs", fens (usually associated with strings in patterned fens), openings in conifer swamps, and "bog" borders;

occasional in areas 1, 2, 3, infrequent in 4 and the northern half of 5. In areas 4 and 5, it is mostly restricted to tamarack swamps. In the Red Lake Peatland, it grows on strings of patterned fens and in disturbed sites (Wheeler *et al.*, 1983). As treated here, our material includes *C. laricina* Mack. [*C. muricata* L. var. *laricina* (Mack.) Gl.]. See comments under *C. angustior*.

C. cephaloidea (Dew.) Dew.

Bracteosae

Deciduous woodlands (wet to dry) and thickets; occasional to frequent in areas 5, 6, 7, infrequent in 9 and the southern portion of 4. It often grows in thickets, particularly under *Zanthoxylum*, where it sometimes occurs in abundance. Some workers (e.g. Gleason and Cronquist, 1963) treat it as *C. sparganioides* Muhl. var. *cephaloidea* (Dew.) Carey.

C. cephalophora Willd.

Bracteosae

Dry deciduous woodlands and thickets, sandy hillsides, exposed ravines, and the margins of mesic hardwood stands; occasional in areas 5, 6, 7.

C. chordorrhiza L. f.

Chordorrhizeae

Open oligotrophic and mesotrophic "bogs", floating peat mats surrounding acid and alkaline kettle-hole lakes, openings and edges of conifer swamps, and fens; occasional to frequent in areas 1, 2, 3, infrequent in 4 and the northern portions of 5, 6. In areas 4, 5, and 6, it is mostly confined to openings in tamarack swamps. In the Red Lake Peatland, it grows in poor- and rich-fen sites and serves as an indicator of minerotrophy in ecotones between ombrotrophic and minerotrophic areas (Glaser *et al.*, 1981; Wheeler and Glaser, 1982; Wheeler *et al.*, 1983). The plant seems to require at least moderate light for best growth, and it has a most unusual and well-marked habit of growth, where old prostrate culms of the previous year give rise to new plants from the nodes.

C. communis Bailey

Montanae

Rocky ledges in woodlands, cliffs and bluffs and, less commonly, on rocky shores; infrequent to occasional in the eastern half of the state. Best known from rocky ledges along the shores of Lake Superior. According to Handel (1978a), this species is a myrmecochore, with the perigynia having elaiosomes that attract ants to carry diaspores to their nests. He claims that when the fruits become mature, the culms bend, thus placing the perigynia at ground level.

C. comosa Boott*Pseudocypereae*

Marshes, floating peat mats of alkaline kettle-hole lakes, wet ditches, and the borders of lakes, "bogs", and swamps; frequent in areas 3, 4, 5, infrequent to occasional in 1, 6, 7.

C. conjuncta Boott*Vulpinae*

A single station is known in Minnesota. It was collected from a lowland forest bordering the Cannon River (Rice County), where several clumps were observed just where the floodplain gives way to higher ground. Of some interest, two other uncommon Minnesota carices, *C. davisii* and *C. grayi*, were also observed in this lowland forest, both of which were present in some abundance. Although *C. conjuncta* somewhat resembles *C. alopecoidea*, the sheaths of the former are conspicuously cross-puckered whereas those of the latter are smooth. *C. conjuncta* is well known to the south and southeast of us, such as in northern Missouri (Steyermark, 1963), Illinois (Mohlenbrock and Ladd, 1978), and the southern half of Iowa (Gilly, 1946), but it is uncommon or rare in northern Iowa (Gilly, 1946) and Wisconsin (Zimmerman, personal communication). It appears to be very rare in Minnesota. This note represents the first report of this species from the state.

Rice Co.: Cannon River Wilderness Area, floodplain forest, T111N, R20W, Sec. 34, *Wheeler* 5297 (MIN).

C. conoidea Willd.*Griseae*

Moist meadows, low prairies and, more rarely, thinly-wooded areas; known only from a few sites scattered throughout the state. Well known from the environs of the Twin Cities Army Arsenal (Ramsey County), where it grows along the margins of Marsden Marsh and also, albeit rarely, on partially-shaded wooded banks overlooking the marsh. See comments under *C. katahdinensis*.

C. convoluta Mack.*Bracteosae*

Deciduous woodlands (mesic to dry) and thickets; frequent to common in areas 5, 6, 7, occasional in 4, infrequent in 9, uncommon in 3. Although some workers (e.g. Gleason and Cronquist, 1963) do not treat this entity as distinct from *C. rosea*, in Minnesota these two taxa are well-marked and easily distinguished, both morphologically and in geographic distribution. Regarding the latter, *C. convoluta* is restricted to the central and southern portions of Minnesota whereas *C. rosea* occurs throughout most of the state.

Where the ranges of the two species overlap, *C. rosea* clearly grows over a much wider range of soil types, with *C. convoluta* more or less confined to rich sites.

C. crawei Dew.

Granulares

Low prairies, moist meadows, swales, ditches, and marly shores of lakes and, less commonly, railroad and highway embankments (especially prairie strips); occasional to frequent in areas 4, 8, infrequent in 2, 9, uncommon in 1, 5.

C. crawfordii Fern.

Ovales

Moist, open sites (e.g. meadows, ditches, clearings, roadside embankments, borders of lakes and ponds, sandy shores and, less commonly, the borders of "bogs" and swamps); frequent to common in areas 1, 2, 3, infrequent to occasional in 4 and the northern portions of 5, 6.

C. crinita Lam.

Cryptocarpae

Mixed conifer-hardwood and alder swamps, woodland swales and pond margins, wooded river banks and, less commonly, wet ditches; occasional to frequent in areas 1, 3, infrequent in 2 and the eastern half of 4, uncommon in the northern portions of 5, 6. In Minnesota, only *C. crinita*, *C. gynandra*, and *C. tuckermanii* have achenes that are consistently deeply invaginated on one side. See comments under *C. gynandra*.

C. cristatella Britt.

Ovales

Floodplain forests, abandoned river channels and ox-bows, moist meadows, wet ditches, and the marshy margins of ponds, lakes, and streams; occasional to frequent throughout the state, except in area 1, where it is uncommon. The plants often produce numerous nonflowering pseudoculms along with the fertile culms.

C. crus-corvi Kunze

Vulpinae

Two stations are known for this species in Minnesota: marshy edge of the Mississippi River near Weaver, Wabasha County [*Fassett and Hotchkiss 3087* (GH)]; wet site near Red Wing in Goodhue County [Sandberg in 1885 (MIN)]. Fernald (1937) also mapped it as occurring in east-central and extreme south-central Minnesota, but specimens from these areas have not been seen. This species has not been collected in the state for some fifty years, and recent efforts to recollect it have failed. It appears to be very rare in Minnesota (if not already extirpated from the state).

C. cryptolepis Mack. *Extensae*

Moist to wet places, such as meadows, "bog" and swamp borders, and the marshy margins of lakes; occasional in areas 1, 3, infrequent in 2, 4 and the northern portion of 5. Some workers (e.g. Fernald, 1950) treat it as *C. flava* L. var. *fertilis* Peck.

C. davisii Schwein. & Torr. *Gracillimae*

Floodplain forests of large rivers in southeastern Minnesota; local in areas 6, 7. It appears to be rare in the state. Probably best known from the Cannon River Wilderness Area (Rice County), where it grows in lowland forest (see comments under *C. conjuncta*). Erroneously reported (Stevens, 1972; McGregor *et al.*, 1977) for North Dakota; see comments under *C. formosa* and also Wheeler, 1983a.

C. debilis Michx. *Sylvaticae*

Wet acid woods, wooded ridges bordering "bogs" and swamps and, less commonly, sandy roadside embankments; infrequent to occasional in the eastern portions of areas 3, 4, 5. Best known from Anoka (Lemon, 1943) and Pine counties. Our material may be referred to var. **rudgei** Bailey.

C. deflexa Hornem. *Montanae*

Mixed conifer-hardwood forests and swamps, rocky woods, pine forests, cliffs and bluffs, and "bog" borders; occasional in area 1, infrequent in 2, 3.

C. deweyana Schwein. *Deweyanae*

Deciduous woodlands (wet to dry), mixed conifer-hardwood forests and swamps, conifer and alder swamps, clearings, and rocky woods and bluffs; common in the northern half of the state, occasional to frequent in the southern half (except in the west, where it is uncommon).

C. diandra Schrank *Paniculatae*

Wet meadows, fens (usually associated with flarks in patterned fens), floating peat mats surrounding alkaline kettle-hole lakes, wet ditches, and "bog" and swamp borders; frequent in area 2, occasional in 1, 3, 4, 5, uncommon in 6. In the Red Lake Peatland, it occurs in flarks of patterned fens and on wooded islands as well as in disturbed sites (Wheeler and Glaser, 1982; Wheeler *et al.*, 1983).

C. disperma Dew.*Heleonastes*

Conifer and mixed conifer-hardwood swamps, alder swamps, "bog" borders, and the mossy shaded banks of streams; frequent to common in areas 1, 2, 3, occasional in 4 and the northern half of 5. In the Red Lake Peatland, it is mostly confined to the sides and tops of hummocks on the rich-fen wooded islands (Wheeler *et al.*, 1983).

C. eburnea Boott*Albae*

Steep wooded ridges and partially-shaded limestone and sandstone bluffs; occasional to frequent in areas 5, 6, 7, infrequent in 4, 8, 9, uncommon in 3. Best known from bluffs bordering the Minnesota and Mississippi rivers and their tributaries, where it often grows in dense mats under *Juniperus*. This species retains its fruits for a long time after maturity (Hermann, 1940) and, indeed, it is not unusual to find plants displaying perigynia produced from two consecutive years.

C. eleocharis Bailey*Divisae*

Prairies, dry hillsides, railroad and highway embankments (especially prairie strips), rock outcrops, and sand barrens; occasional to frequent in the western half of the state, infrequent in the eastern half. A strongly rhizomatous species sometimes occurring in great abundance on dry hillsides and slopes in western Minnesota. Some workers (e.g. Fernald, 1950) treat it as *C. stenophylla* Wahlenb. var. *enervis* (C. A. Mey.) Kükenth.

C. emoryi Dew.*Acutae*

Along river banks, where it often forms large beds of nearly pure stands; it also frequents, though less commonly, floodplain forests, wet ditches, prairie swales, and the margins of ponds and lakes. Frequent to common throughout the state, except in area 1, where it is uncommon. Clearly the most commonly-occurring and abundant sedge along the rivers of our state. Some workers (e.g. Gleason and Cronquist, 1963) treat it as *C. stricta* Lam. var. *elongata* (Boeckl.) Gl.

C. exilis Dew.*Stellulatae*

Best known from the Red Lake Peatland (Wheeler and Glaser, 1979, 1982; Glaser *et al.*, 1981; Wheeler *et al.*, 1983), where it is locally abundant in narrow strips of open poor-fen ecotone that separate ombrotrophic bogs from minerotrophic fens; it also occurs,

though less commonly, in flarks and on strings. Outside the Red Lake area, the species is known only from a few patterned fens (primarily in flarks) in the north-central and northeastern portions of the state (Glaser, 1983; Wheeler, 1983b).

C. festucacea Willd.

Ovales

A single station is known in Minnesota. It was collected from a lowland woods bordering the Des Moines River, where a few clumps were observed growing on slightly raised banks. The species is distinguished from other Minnesota members of the *Ovales* by the following combination of characters: spikelets with conspicuous clavate staminate bases; inflorescence more or less straight, not nodding; body of perigynium suborbicular and rather abruptly narrowed to the beak. This species is well known to the south and southeast of us, such as in Missouri (Steyermark, 1963), Illinois (Mohlenbrock and Ladd, 1978), and the southern half of Iowa (Gilly, 1946), but it is very uncommon or rare in North Dakota (McGregor *et al.*, 1977) and Michigan (Voss, 1972b). It appears to be very rare in Minnesota. This note represents the first report of this species from the state.

Jackson Co.: Kilen Woods State Park, low woods, T103N, R35W, Sec. 17, Wheeler 5828 (MIN).

C. filifolia Nutt.

Filifoliae

Prairies, dry hillsides and eroded slopes, and sand barrens; occasional in areas 8, 9, infrequent in the western portions of 4, 5. This species grows in dense tufts that often appear to form rings, apparently through some dying out of older plants at the center (Hudson, 1977); the old sheaths are almost invariably broken off evenly about 2 cm above ground level. In Minnesota, only *C. filifolia* and *C. obtusata* consistently have a well-developed rachilla within the perigynium. See comments under *C. obtusata*.

C. flava L.

Extensae

Moist meadows, springy places in forests, and "bog" borders; local in area 1. It appears to be rare in the state.

C. foenea Willd.

Arenariae

Dry, open sites. In the north, the plant frequents the margins of jack pine forests and pioneer hardwood stands, sandy ridges and clearings, and sandy disturbed sites (roadside shoulders and embankments, sand and gravel pits). In the southeast, it frequents

sand barrens, dry hillsides, railroad and highway embankments (especially prairie strips), and sandy disturbed sites. Occasional to frequent in the northern half of Minnesota, infrequent to occasional in the east-central and southeastern portions of the state. A rhizomatous species often abundant in dry, sandy soil. Some workers (e.g. Gleason and Cronquist, 1963) still refer to this entity as *C. siccata* Dew.

C. formosa Dew.

Gracillimae

Known only from dry deciduous woodlands in Ramsey County, where it is very local. It appears to be very rare in the state. Although this species is reported by Fernald (1950) as extending no farther west than Minnesota, it is also known from Richland County, North Dakota (see comments under *C. davisii* and also Wheeler, 1983a).

C. garberi Fern.

Bicolores

One station is known for this species in Minnesota: a marshy roadside near Cotton in St. Louis County (Wheeler, 1983b). Although *C. garberi* is sometimes difficult to distinguish from *C. aurea*, the Minnesota material has all the characteristics of the former: perigynia densely crowded, strongly overlapping, granular, whitish; pistillate scales rounded at the summits, not short-pointed. In contrast, the pistillate scales of *C. aurea* are almost invariably short-pointed and the perigynia are generally not crowded or overlapping and the latter, when dry, are usually pale brown or beige and not very granular. Unfortunately, a recent effort to recollect the species near Cotton was unsuccessful. It appears to be very rare in the state.

C. gracillima Schwein.

Gracillimae

Deciduous forests (mesic to wet), alder swamps, mixed conifer-hardwood forests and swamps, wooded banks of rivers and, less commonly, moist meadows and highway embankments; common in areas 1, 2, 3, 4, frequent in 5, occasional in 6, 7.

C. granularis Willd.

Granulares

Moist meadows and clearings, fens, prairie swales, borders of wet woods and, less commonly, wooded bluffs; occasional throughout the state, except in the northeast, where it is unknown. Our material may be referred to var. **haleana** (Olney) Porter.

C. gravida Bailey*Bracteosae*

Dry hillsides, pastures and abandoned fields, railroad and highway embankments (especially prairie strips), river banks, woodland margins, prairies, and rock outcrops; frequent in the southern half of the state, infrequent in the northern half.

C. grayi Carey*Lupulinae*

Floodplain forests of large rivers (especially the Mississippi River); infrequent in areas 6, 7, rare in 4. Most Minnesota material is var. **grayi** (with glabrous perigynia), but var. **hispidula** Bailey (with hispidulous perigynia) is known from a floodplain woods near Reads Landing in Wabasha County (Wheeler, 1979). Some workers (e.g. Gleason and Cronquist, 1963; Reznicek and Ball, 1974) do not recognize var. *hispidula*, and thus regard the presence or absence of perigynium pubescence as part of the normal variation of the species. These two taxa have not been mapped separately. See comments under *C. conjuncta*.

C. gynandra Schwein.*Cryptocarpae*

Wet sites in northeastern Minnesota, especially near Lake Superior (Wheeler, 1983b). It most often frequents the margins of conifer swamps, wet meadows, and the banks of streams; infrequent in area 1, uncommon in the eastern portion of 3. This entity is sometimes treated (e.g. Fernald, 1950; Gleason and Cronquist, 1963) as a variety of *C. crinita*, as var. *gynandra* (Schwein.) Schwein. & Torr., but these two taxa are well-marked and easily distinguished in Minnesota and Wisconsin (Wheeler, 1983b) as well as elsewhere (Voss, 1972b; Standley, 1983). Standley (1983) recently found the two taxa to be distinct on the basis of morphological differences and reproductive isolation. See comments under *C. crinita*.

C. gynocrates Drej.*Dioicae*

Conifer swamps, wooded mesotrophic "bogs" and, less commonly, alder swamps; occasional in areas 2, 3, infrequent in 1, 4, uncommon in 5. In areas 4 and 5, it is confined to tamarack swamps. A small, usually dioecious species that is easily overlooked, particularly the staminate plants (however, the latter sometimes bear one or two perigynia at the bottom of the spike).

C. hallii Olney*Atratae*

Prairie swales; local in area 8. It is a polymorphic species that appears to be rare in the state.

C. haydenii Dew.*Acutae*

Wet sandy swales and moist meadows; occasional in the eastern half of the state, infrequent in the western half. It is sometimes a dominant species in wet sandy swales, where it often associates with *C. buxbaumii*. In richer soils it is usually replaced by such species as *C. lacustris* and *C. atherodes*.

C. heliophila Mack.*Montanae*

Prairies, dry hillsides, bluffs and cliffs, sand barrens, and railroad and highway embankments (especially prairie strips); occasional to frequent in areas 4, 5, 6, 7, 8, 9. Some workers (e.g. Fernald, 1950) treat it as *C. pensylvanica* Lam. var. *digyna* Boeckl.

C. hirtifolia Mack.*Triquetrae*

Mesic deciduous forests; occasional to frequent in areas 5, 6, 7, infrequent in 4. Best known from the southeast, where the plant (all parts of which are pubescent) sometimes occurs in abundance in rich woodlands.

C. hitchcockiana Dew.*Oligocarpae*

Steep hardwood-covered slopes, wooded ravines and, less commonly, flat deciduous woodlands; occasional in area 5, infrequent in 6, 7. Best known from wooded bluffs of the Minnesota River (Wheeler, 1981b).

C. houghtoniana Dew.*Carex*

Margins of pine stands, wet sandy shores, and sandy disturbed sites (e.g. sand and gravel pits, railroad tracks, roadside shoulders and embankments, clear-cut and burned-over areas); occasional to frequent in areas 1, 2, 3, infrequent in 4, uncommon in 5, 6. According to Hudson (1977), the rhizomes of this species grow vigorously in response to disturbance.

C. hystericina Willd.*Pseudocypereae*

Conifer and mixed conifer-hardwood swamps, alder swamps, shrub-carrs, wet meadows and ditches, marshy margins of lakes and streams, and "bog" and swamp borders; frequent to common throughout the state.

C. interior Bailey*Stellulatae*

Conifer and mixed conifer-hardwood swamps, alder swamps, fens, prairie swales, wet meadows and, less commonly, ditches, pastures, and "bog" and swamp borders; occasional to frequent throughout Minnesota, except in the southeast corner, where it is very uncommon. In the southern half of the state, this species primarily grows in tamarack swamps and in spring-fed, calcareous fens. In the Red Lake Peatland, it grows in flarks of patterned fens, in wet depressions on the wooded rich-fen islands, and in disturbed sites (Wheeler *et al.*, 1983). In Minnesota, this species grows on richer sites than the closely related species *C. cephalantha* and *C. angustior*; this observation has also been reported from elsewhere (Damman, 1964).

C. intumescens Rudge*Lupulinae*

Deciduous woodlands (mesic to wet), mixed conifer-hardwood forests and swamps, alder swamps, and wooded river banks; common in areas 1, 2, 3, occasional to frequent in 4, 5, infrequent in 6. Our material may be referred to var. **fernaldii** Bailey.

C. katahdinensis Fern.*Griseae*

Known only from the environs of Iron Lake in northern St. Louis County, where it grows on sandy beaches and amongst shore rocks (Lakela, 1952; Wheeler, 1983b). Because in Minnesota *C. katahdinensis* and *C. conoidea* are well-marked and easily distinguished both morphologically and ecologically (Wheeler, 1983b), they are treated here as separate species. However, some workers (Ball and White, 1982) claim that the northern populations of *C. conoidea* consist of dwarf individuals with a crowded inflorescence whereas the more southerly populations consist of tall individuals with a lax inflorescence. Boivin (1967) treats this entity as a form of *C. conoidea* Willd., as forma *katahdinensis* (Fern.) Boivin.

C. lacustris Willd.*Paludosae*

Marshes, prairie swales, woodland ponds, ditches, wooded swamps, and the borders of lakes, rivers, "bogs", and swamps; common throughout the state, except for the southeast and southwest corners, where it is uncommon or unknown. It is often the dominant plant in and around the margins of woodland ponds, and it is one of the most common sedges bordering tamarack swamps. However, in prairie swales it is often replaced by *C.*

atherodes. In the Red Lake Peatland proper it is infrequent in the environs of ditches, but along creeks bordering the mire and in lags it is widespread and common (Wheeler *et al.*, 1983).

C. laeviconica Dew.

Paludosae

River banks, abandoned river channels and ox-bows and, less commonly, prairie swales, wet ditches, and the marshy borders of lakes and ponds; occasional to frequent in the southern half of the state and in the Red River Valley.

C. laevivaginata (Kükenth.) Mack.

Vulpinae

One station is known for this species in Minnesota: a wet site near Spring Grove in Houston County [*Rosendahl* 456 (MIN)]. This species appears to be very rare in the state, and it has not been collected in Minnesota since 1902.

C. lanuginosa Michx.

Carex

Meadows, marshes, swales, wet prairies, ditches, pastures and abandoned fields, and the borders of lakes and ponds; frequent to common throughout the state. One of the most commonly-occurring carices in wet, open sites. Some workers (e.g. Gleason and Cronquist, 1963) treat it as *C. lasiocarpa* Ehrh. var. *latifolia* (Boeckl) Gilly.

C. lasiocarpa Ehrh.

Carex

Open mesotrophic "bogs", floating peat mats surrounding alkaline kettle-hole lakes, fens, and "bog" and swamp borders; common in areas 1, 2, 3, occasional to frequent in 4 and the northern portion of 5, infrequent in 6, 8. Clearly the most common and abundant sedge in rich fen in the northern half of the state. In the Red Lake Peatland, it occurs in poor- and rich-fen sites and is the dominant species in flarks of patterned fens (Glaser *et al.*, 1981; Wheeler and Glaser, 1982; Wheeler *et al.*, 1983). Our material may be referred to var. **americana** Fern.

C. laxiculmis Schwein.

Laxiflorae

This sedge is confined to steep, north- and east-facing wooded slopes of deep stream valleys in area 7, where it is locally abundant. All of our specimens have conspicuously serrulate bract-sheaths and sharply-angled culms, as well as gynaeandrous lateral spikelets. Material possessing these characters is sometimes treated (Hermann, 1940) as var. *copulata* (Bailey) Fern. or even given

species rank (Mackenzie, 1931–1935) as *C. copulata* (Bailey) Mack. Fernald (1950), however, treats this entity as a hybrid between *C. laxiculmis* and *C. digitalis*, and Zimmerman (personal communication) considers all of the Wisconsin material of this type to be *C. digitalis*. Still others (e.g. Gleason and Cronquist, 1963) do not treat this entity as distinct from *C. laxiculmis*. Of some interest, Hermann (1940) states that var. *copulata* is a calciphile whereas the var. *laxiculmis* grows best in neutral or only slightly calcareous soils. The distribution of var. *copulata* is given by Hermann (1940) as ranging from New Jersey to Missouri and northward to Michigan. It seems clear that the calcareous bluffs of southeastern Minnesota provide the habitats for the northwesternmost stations for this entity in North America. This note represents the first report of this species from the state.

Houston Co.: 9 mi. SW of Reno, north-facing wooded bluff overlooking Winnebago Creek, 0.25 mi. E of Rte. 5, T101N, R5W, Sec. 15, *Wheeler 4199* (MIN). Beaver Creek Valley State Park, north-facing wooded bluff overlooking Beaver Creek, T102N, R6W, Sec. 5, *Wheeler 4238* (MIN). 3 mi. SE of Caledonia, north-facing wooded bluff overlooking South Fork Crooked Creek, T102N, R5W, Sec. 29, *Wheeler 4804* (MIN). Winona Co.: Whitewater State Park, 3 mi. SW of Alba on Rte. 74, east-facing wooded bluff overlooking Middle Fork Whitewater River, T107N, R10W, Sec. 20, *Wheeler 3646* (MIN).

C. lenticularis Michx.

Acutae

Rocky shores and sandy lake beaches; occasional to frequent in area 1. Well known from the shores of Lake Superior, where it grows amongst rocks and along the margins of rock pools.

C. leptalea Wahlenb.

Polytrichoideae

Wooded mesotrophic "bogs", conifer and mixed conifer-hardwood swamps, alder swamps and, more rarely, fens: common in areas 1, 2, 3, frequent in 4, occasional in 5. In areas 4 and 5, this species is mostly confined to tamarack swamps. In the Red Lake Peatland, it occurs in open fens (flarks and string margins) and on wooded islands, and it serves as an obligate rich-fen indicator (Glaser *et al.*, 1981; Wheeler *et al.*, 1983). The plants often grow in dense mats in deeply-shaded places, and it has been suggested (Wheeler *et al.*, 1983) that reduced light greatly favors asexual propagation in the species.

C. leptonervia Fern.

Laxiflorae

Deciduous forests (mesic to wet), mixed conifer-hardwood forests and swamps, alder swamps and, less commonly, pioneer hardwood

stands; occasional to frequent in areas 1, 3 and the eastern portion of 2. Whereas *C. blanda* is the most commonly-occurring member of the *Laxiflorae* in our southern hardwood forests, *C. leptonevia* is the most commonly-occurring member of this group in our northern hardwood and mixed conifer-hardwood forests. The ranges of these two species in the state are more or less exclusive and rarely, if ever, do the two species occur in the same forested area.

C. limosa L.

Limosae

Open oligotrophic and mesotrophic "bogs", floating peat mats surrounding acid and alkaline kettle-hole lakes, fens, and openings in conifer swamps; frequent in areas 1, 2, 3, occasional in 4, infrequent in 5, 8, uncommon in 6, 9. In areas 4, 5, 6, 8, and 9, this species is mostly confined to spring-fed, calcareous fens and to openings in tamarack swamps. In the Red Lake Peatland, the plant frequents poor- and rich-fen sites, where it grows in flarks and, less commonly, on strings (Wheeler *et al.*, 1983). This species greatly resembles the closely related *C. paupercula* (see comments under this species) and, like it, has roots that are conspicuously covered with numerous yellowish-tinged root hairs.

C. livida (Wahlenb.) Willd.

Paniceae

Limy meadows and fens and, less commonly, wet ditches and the margins of conifer swamps (Wheeler, 1983b); infrequent to occasional in areas 1, 2, but at some localities occurring in abundance. In the Red Lake Peatland, this species grows in open poor- and rich-fen sites (primarily associated with flarks and the margins of fen-pools), and it is a frequent indicator of minerotrophy between ombrotrophic and minerotrophic areas (Glaser *et al.*, 1981; Wheeler and Glaser, 1982; Wheeler *et al.*, 1983). Our material may be referred to var. **radicaulis** Paine [*C. livida* var. *grayana* (Dew.) Fern.].

C. lupulina Willd.

Lupulinae

Floodplain forests, woodland swales and pond margins, wooded swamps and, less commonly, wet meadows, ditches, and the marshy borders of lakes and ponds; occasional to frequent in areas 3, 4, 5, 6, 7. Best known from lowland forests bordering the Mississippi and St. Croix rivers.

C. lurida Wahlenb.

Pseudocypereae

One station is known for this species in Minnesota: wet site near Milaca in Mille Lacs County. Although collected in the state in

1892, recent efforts to recollect it have failed. It appears to be very rare in Minnesota (if not already extirpated from the state). In Wisconsin (Zimmerman, personal communication), *C. lurida* is known from a few sites along the Wisconsin and Black rivers.

C. meadii Dew.

Panicaceae

Prairies, sandy hillsides, railroad and highway embankments (especially prairie strips), and the edges of rock outcrops; occasional to frequent in areas 5, 8, 9, occasional in 4, infrequent in 6, 7. See comments under *C. tetanica*.

C. media R. Br.

Atratae

Rocky shores and margins of rock pools, steeply-wooded river banks (especially near waterfalls) and, less commonly, moist meadows, swampy ditches, and "bog" borders; infrequent to occasional in area 1. Best known from the rocky shores of Lake Superior. Some workers (e.g. Gleason and Cronquist, 1963) do not treat this entity as distinct from *C. norvegica* Retz.

C. merritt-fernaldii Mack.

Ovales

Sandy hillsides, gravelly banks, rock outcrops, cliffs and bluffs and, less commonly, edges of pine stands; occasional in areas 1, 2, infrequent in 3, uncommon in 4. Some workers (e.g. Gleason and Cronquist, 1963) do not treat this entity as distinct from *C. brevior* (Dew.) Mack.

C. michauxiana Boeckl.

Folliculatae

Known only from wet ditches near Schroeder in Cook County (Butters and Abbe, 1953; Wheeler, 1983b). It appears to be very rare in the state.

C. molesta Bright

Ovales

River banks, pastures and abandoned fields, prairies, mesic meadows, railroad and roadside embankments and, less commonly, the margins of mesic hardwood stands; occasional in the southern half of the state. Considered by some workers (Gleason and Cronquist, 1963) to be a hybrid between *C. brevior* and *C. normalis*. See Rothrock (1978) for a nomenclatural note.

C. muhlenbergii Willd.

Bracteosae

Sandy hillsides, sand barrens, and dry prairies; occasional in the eastern portions of areas 5, 6, 7. Probably best known from the

Weaver Dunes (Wabasha County) and the sand barrens of the Anoka Sand Plain (e.g., Anoka and Sherburne counties).

C. muskingumensis Schwein.

Ovales

Floodplain forests of large rivers, particularly the Mississippi River (Wheeler, 1979); infrequent to occasional in areas 6, 7, rare in 5. The plants usually bear numerous, leafy pseudoculms along with the fertile culms, both types of which are characteristically very stiff and erect.

C. normalis Mack.

Ovales

Deciduous woodlands (mesic to wet) and thickets; occasional to frequent in areas 6, 7, infrequent in 3, 4, 5.

C. obtusata Lilj.

Obtusatae

Sandy ridges and hillsides, sand barrens, and dry prairies; of local occurrence in area 8 and the northwestern portion of 4. It appears to be rare in the state but is quite abundant at some localities. Probably best known from the Agassiz Dunes Natural Area (Polk County), where it occurs on sand barrens. Of the two Minnesota carices possessing a rachilla (see comments under *C. filifolia*), only *C. obtusata* bears a scale-like appendage at the apex of the structure.

C. oligocarpa Willd.

Oligocarpae

Steep hardwood-covered slopes, wooded ravines and, more rarely, flat deciduous woodlands; occasional in area 5, infrequent in 6, 7. Best known from wooded bluffs of the Minnesota River (Wheeler, 1981b).

C. oligosperma Michx.

Vesicariae

Open ombrotrophic bogs, open oligotrophic "bogs", and floating peat mats surrounding acid kettle-hole lakes; frequent in areas 1, 2, 3, infrequent to occasional in the eastern portion of 4 and the northeastern part of 5. It is one of the most commonly-occurring and abundant sedges in open, oligotrophic sites in the northeastern one-third of the state. In the Red Lake Peatland, where it is often a dominant species, this plant frequents open ombrotrophic bogs, bog drains, and open poor-fen areas (Glaser *et al.*, 1981; Wheeler and Glaser, 1982; Wheeler *et al.*, 1983).

C. ormostachya Wieg.*Laxiflorae*

Hardwood and mixed conifer-hardwood forests (particularly along the drier, more thinly-wooded margins), and wooded river banks; known only from a few scattered sites in areas 1, 3, but it is probably more common in the northeast than our present collections suggest. Some workers (e.g. Gleason and Cronquist, 1963) treat it as *C. laxiflora* Lam. var. *ormostachya* (Wieg.) Gl.

C. pallescens L.*Virescentes*

Known only from moist sites on the Lake Superior terrace near Duluth in St. Louis County (Lakela, 1954; Wheeler, 1983b). It appears to be very rare in the state. Our material may be referred to var. **neogaea** Fern.

C. pauciflora Lightf.*Orthocerates*

Open and partially-shaded ombrotrophic bogs, open and partially-shaded oligotrophic "bogs", floating peat mats surrounding acid lakes and, more rarely, conifer swamps; occasional in areas 1, 2, 3, uncommon in 4. In the Red Lake Peatland, this species frequents open and partially-shaded poor-fens and, less commonly, open and partially-shaded ombrotrophic bogs (Glaser *et al.*, 1981; Wheeler and Glaser, 1982; Wheeler *et al.*, 1983). The plant grows best where the water table is at or close to the peat surface, but it is invariably absent from sites having a mud substrate (Wheeler *et al.*, 1983). The long-pointed, slender perigynia that are strongly reflexed and easily detached at maturity are probably readily dispersed by animals (Savile and Calder, 1953; Wheeler *et al.*, 1983).

C. paupercula Michx.*Limosae*

Open and wooded ombrotrophic bogs, open and wooded oligotrophic and mesotrophic "bogs", floating peat mats surrounding acid and, less commonly, alkaline kettle-hole lakes, and conifer and alder swamps; frequent in areas 1, 2, 3, occasional in 4 and the northeastern portion of 5, rare in 7. In areas 4 and 5, this species is mostly restricted to tamarack swamps. In the Red Lake Peatland, it frequents open and wooded ombrotrophic bogs, open poor-fens, and wooded poor- and rich-fen islands (Wheeler and Glaser, 1982; Wheeler *et al.*, 1983). The species seems to be more acid-tolerant than the closely related *C. limosa* (see comments under this species) and, furthermore, it does not seem to frequent such nutrient-rich sites as the latter (Wheeler *et al.*, 1983). Most Minnesota material is

var. **pallens** Fern., but in the northeast var. **irrigua** (Wahlenb.) Fern. is of occasional occurrence. Because intergrades between these two taxa are frequent, they have not been mapped separately.

C. peckii Howe *Montanae*

Deciduous woodlands (mesic to dry), mixed conifer-hardwood forests and swamps, pioneer hardwood stands, wooded river banks and, more rarely, "bog" borders; frequent throughout the state, except in areas 8 and 9, where it is occasional. Some workers (e.g. Gleason and Cronquist, 1963) treat it as *C. nigromarginata* Schwein. var. *elliptica* (Boott) Gl.

C. pedunculata Willd. *Digitatae*

Deciduous woodlands (wet to dry), mixed conifer-hardwood forests and swamps, conifer and alder swamps, and pioneer hardwood stands; occasional to frequent throughout the state, except in areas 8 and 9, where it is very uncommon. The plant is early fruiting (May), and its distribution in woodlands is often clearly non-random, the majority of colonies occurring on rotting logs, windthrow mounds, and near the bases of trees. This species is a known myrmecochore (Handel, 1976, 1978b), and its "seeds", unlike in most species of *Carex*, are known to germinate the same year they are produced (Handel, 1978b).

C. pensylvanica Lam. *Montanae*

Known from many habitats, particularly woodlands of all types; it rarely occurs, however, in prairies or where the soil is extremely wet (e.g. "bogs", marshes, fens). Very common throughout Minnesota, except for the extreme northeast, where it is infrequent. This species is probably the most commonly-occurring and widespread sedge in the state, and it is sometimes very abundant in dry deciduous woodlands.

C. plantaginea Lam. *Laxiflorae*

Steep hardwood-covered slopes and moist wooded ravines; very local in east-central and southeastern Minnesota. It appears to be very rare in the state.

C. praegracilis W. Boott *Divisae*

Low prairies, moist meadows, swales, wet depressions along railroad and highway embankments (especially prairie strips), ditches and, less commonly, moist places around rock outcrops; fre-

quent in western and south-central Minnesota, adventive in the north-central, northeastern, and extreme east-central portions of the state (Wheeler, 1983b).

C. prairea Dew.

Paniculatae

Low prairies, wet meadows and ditches, swales, marshes, and the borders of lakes and streams; occasional throughout the state, except in the northeast and southeast corners, where it is rare or unknown. This species sometimes dominates wet meadows and margins of lakes; its brightly-colored sheaths (yellow-brown to bronze) are quite conspicuous. Some workers (e.g. Van Bruggen, 1976; McGregor *et al.*, 1977) still refer to this entity as *C. prarisa* Dew.

C. praticola Rydb.

Ovales

Bluff-tops, cliffs, and sandy and rocky ground; very local in area 1. Best known from bluff-tops bordering lakes of the Rove Slate Formation, near the Minnesota-Ontario border (Cook County). Although *C. praticola* can be easily confused with *C. aenea*, some Minnesota specimens clearly have the characteristics of the former: beak of the perigynium terete at the tip (the latter about 0.4 mm long and white-hyaline or light brown), with the serrulate wing abruptly terminating where the terete portion begins; perigynia less than two-fifths as wide as long, 4.5–6 mm long (average about 5.3 mm); spikelets in a flexuous inflorescence, silver-green or pale brown. This species appears to be very rare in the state.

C. projecta Mack.

Ovales

Floodplain forests, conifer and mixed conifer-hardwood swamps, alder swamps, woodland swales and pond margins, wet clearings and ditches, and the borders of "bogs", lakes, and rivers; frequent in areas 1, 2, 3, occasional in the eastern half of 4, infrequent in 5, 6. This species often forms dense colonies by developing bud scales at the base of sheaths on old prostrate culms that over-winter and develop into independent plants the following year (Weatherby, 1945).

C. pseudocyperus L.

Pseudocypereae

Marshy margins of lakes, "bog" borders and, less commonly, wooded swamps, fens, and wet ditches; frequent in areas 2, 3, occasional in 1, 4 and the northern half of 5, uncommon in 8. In the Red Lake Peatland, this species serves as an obligate rich-fen

indicator and is best known from wooded rich-fen islands (Wheeler and Glaser, 1982; Wheeler *et al.*, 1983).

C. retrorsa Schwein.

Lupulinae

Floodplain forests, conifer and mixed conifer-hardwood swamps, alder swamps, shrub-carrs, marshes, wet ditches, and the borders of lakes, rivers, and ponds; frequent to common in the northern half of the state, occasional in the southern half.

C. richardsonii R. Br.

Digitatae

Pine forests, dry hillsides, prairies, and sandy disturbed sites (e.g. sand and gravel pits, roadside embankments); occasional in the northern half of the state, infrequent in the southern half. Well known from the Grand Rapids area (Itasca County), where it is of rather frequent occurrence along the outer margins of red pine stands.

C. rosea Willd.

Bracteosae

Deciduous woodlands (wet to dry), thickets, mixed conifer-hardwood forests and swamps, and conifer and alder swamps; common throughout the state, except in the northeast, where it is very infrequent. One of the most common sedges in deciduous and mixed conifer-hardwood forests. Although there was a proposal (Webber and Ball, 1979) to reject the name *C. rosea* (and *C. radiata*), it was opposed by Boivin (1981), and, more recently, it was not accepted by the Committee for Spermatophyta (Taxon 32: 623–624, 1983). See comments under *C. convoluta*.

C. rossii Boott

Montanae

Two stations are known for this species in Minnesota: rocky soil in Carlton County [*Sandberg* in 1891, exact location unknown (MIN)]; an island in Lake Pokegama [*Sandberg* 276 (WIS)], presumably in Pine County and mapped as such. *C. rossii* is a Western Mountain element plant with disjunct populations known from the Black Hills (Van Bruggen, 1976) and the Great Lakes region (Fernald, 1935); the stations in northern Michigan (Keweenaw County) are the easternmost (Fernald, 1935). It is possible that this species was more widespread in Minnesota during the xerothermic period, and that it is a relict of wider eastern distribution during that time. Presently, it appears to be very rare in the state.

C. rostrata Stokes*Vesicariae*

Marshy margins of lakes and rivers, "bog" borders, fens (usually confined to flarks in patterned fens), prairie swales, shrub-carrs, and wet ditches; common in wetlands throughout the state, but usually replaced by *C. atherodes* in depressions that dry up during the summer. In the Red Lake Peatland proper this species is infrequent to occasional in flarks of patterned fens and in the environs of ditches, and it is very common and abundant along creeks bordering the mire and in laggs (Wheeler *et al.*, 1983). Our material may be referred to var. **utriculata** (Boott) Bailey.

C. sartwellii Dew.*Intermediae*

Moist to wet meadows, prairie swales, fens, wet ditches and, less commonly, swamp margins; occasional to frequent in the central and western portions of the state, rare or unknown in the northeast and extreme southeast.

C. saximontana Mack.*Phyllostachyeae*

Steep hardwood-covered slopes, wooded ravines, shaded river banks, thickets and, less commonly, flat deciduous woodlands; occasional in the western and south-central portions of the state. Best known from bluffs of the Minnesota River, particularly westward. On steep slopes, and especially where plants have flowering culms hanging over precipitous ledges, the subglobose fruits of this species often "roll" short distances downslope from a parent plant; no doubt many other fruits are later washed downslope by rain. For *C. saximontana*, and probably also for *C. backii*, gravity (which is greatly aided by the roundish shape of the fruits of these species) often seems to serve as an effective short-distance dispersal mechanism for diaspores (Wheeler, 1981a).

C. scirpiformis Mack.*Scirpinae*

Prairie swales; local in area 8 and the northwestern portion of 4. It appears to be rare in the state. Some workers (e.g. Fernald, 1950) treat it as *C. scirpoidea* Michx. var. *scirpiformis* (Mack.) O'Neill & Duman.

C. scoparia Willd.*Ovales*

Moist meadows, ditches, clearings, wet sandy margins of lakes and, less commonly, pastures and old fields, moist ledges, and "bog" and swamp borders; frequent in the northern two thirds of the state, occasional in the southern one third.

C. sparganioides Willd.*Bracteosae*

Deciduous forests (mesic to dry); occasional to frequent in areas 5, 6, 7, uncommon in 4.

C. sprengei Spreng.*Longirostres*

Deciduous forests (dry, mesic and, more rarely, wet), river banks, thinly-wooded hillsides and, less commonly, roadside embankments and the margins of rock outcrops; common throughout the state, except in the northeast, where it is very infrequent. The plants often grow in large colonies, and they invariably have thick, pale brown fibrous bases due to partial decomposition of old leaves (Thomas, 1982).

C. sterilis Willd.*Stellulatae*

Fens that are calcareous and persistently wet; infrequent to occasional in areas 4, 5, 8, uncommon in 3, 6. Probably best known from fens bordering the Mississippi River just southwest of Mendota (Dakota County). Unlike some closely related species (e.g. *C. interior*), the spikelets of this sedge, particularly the terminal one, invariably lack prolonged clavate staminate bases. Some workers (e.g. Gleason and Cronquist, 1963) treat it as *C. muricata* L. var. *sterilis* (Carey) Gl.

C. stipata Willd.*Vulpinae*

Floodplain forests, conifer and mixed conifer-hardwood swamps, alder swamps, marshes, woodland swales and pond margins, wet ditches, shrub-carrs, moist to wet meadows and pastures, and the borders of ponds and streams; frequent to common throughout the state, except in the far west, where it is occasional.

C. stricta Lam.*Acutae*

Wet meadows, marshes, ditches, and the margins of swamps, "bogs", lakes, and streams; frequent to common throughout the state, except in the southeast, where it is occasional. This sedge is often a dominant in wet meadows, and at some localities its tussocks are prominent over large areas. Most Minnesota material is var. **strictior** (Dew.) Carey, but var. **stricta** also occurs at scattered localities in the eastern half of the state; these two taxa have not been mapped separately.

C. supina Willd.*Lamprochlaenae*

Known from cliff-talus at Clearwater Lake in northern Cook County (Butters and Abbe, 1953; Wheeler, 1983b). There is also a

report of the plant from South Fowl Lake (Bailey, 1892), but no specimen has been seen. *C. supina* is a circumpolar, low-arctic plant (Raymond, 1951; Given and Soper, 1981) with disjunct populations known from southern Manitoba (Scoggan, 1957, 1978), southern Ontario (Morton, personal communication), and northeastern Minnesota, with the latter having the southernmost stations in North America (Butters and Abbe, 1953). It is very possible that this species was more common in Minnesota during late-glacial time, and that it is a relict of wider distribution in the past (Butters and Abbe, 1953; Wheeler, 1983b). Some support for this comes from Michigan (Miller and Benninghoff, 1969), where macrofossil material of this species has been reported (dated between 13,300 and 12,500 years B.P.). At the present time it appears to be very rare in Minnesota. Our material may be referred to var. **spaniocarpa** (Steud.) Boivin [*C. supina* ssp. *spaniocarpa* (Steud.) Hult.].

C. sychnocephala Carey

Ovales

Damp sandy shores of lakes and streams, swales, marshes, and moist to wet meadows; occasional to frequent throughout the state, except in the northeast and southeast corners, where it is uncommon. According to Hudson (1977), it appears to be a plant of the early stages of succession, not persisting for long after a closed perennial cover gets established.

C. tenera Dew.

Ovales

Thinly-wooded hillsides, woodland margins, wooded river banks, and moist meadows; occasional to frequent throughout the state.

C. tenuiflora Wahlenb.

Heleonastes

Open and wooded oligotrophic and mesotrophic "bogs", floating peat mats surrounding acid and, more rarely, alkaline kettle-hole lakes, fens (usually associated with strings in patterned fens), and conifer swamps; occasional in areas 1, 2, 3, uncommon in 4, 5. In areas 4 and 5, it is mostly restricted to tamarack swamps. In the Red Lake Peatland, it grows primarily on the strings of patterned fens but is also known from hummocks in the poor- and rich-fen wooded islands (Wheeler *et al.*, 1983).

C. tetanica Schkuhr

Paniceae

Low prairies, swales, moist meadows, ditches, and the marshy margins of ponds; frequent to common in areas 5, 8, 9, occasional in 4 and the western portion of 2, infrequent in 3, 6, introduced in 1

(rare). Dried herbarium specimens of *C. tetanica* and *C. meadii* are sometimes difficult to separate, but in the field the two entities are fairly distinctive. *C. tetanica* grows primarily in wet, peaty sites and typically has narrow leaves (2–4.5 mm wide) and pistillate spikelets that are often loosely flowered at the base (the lower perigynia barely or not overlapping). In contrast, *C. meadii* grows in much drier sites, such as in dry prairies, and generally has broader leaves (3–7 mm wide) and pistillate spikelets that are usually tightly compacted, even at the base. The distributions of the two taxa in Minnesota are somewhat similar, but some differences are noteworthy. *C. tetanica* is of frequent occurrence in peaty meadows in Lake of the Woods, western Beltrami, and Clearwater counties, but *C. meadii* is unknown from these counties (they essentially lack prairie sites). On the other hand, *C. tetanica* is very rare or absent from the extreme southeastern corner of Minnesota (part of the Driftless Area), an area lacking low, wet, calcareous sites. However, *C. meadii* is known from various “goat” prairies in this area. The same situation, as regards the presence of *C. meadii* and the absence of *C. tetanica*, also seems to hold throughout the remainder of the Driftless Area (Hartley, 1966).

C. tonsa (Fern.) Bickn.

Montanae

Margins of pine forests, sand barrens, sandy ridges and rocky ledges, and sandy disturbed sites (e.g. sand and gravel pits, roadside shoulders and embankments, clearings and openings); occasional in the eastern half of the state, particularly northward. Here we choose to be traditional and treat *C. tonsa* and *C. umbellata* as separate species, but because in Minnesota these two entities more or less frequent the same habitats and sometimes grow together, one may be justified in treating them as varieties of the same species. When treated as a variety of *C. umbellata* (as the epithet *umbellata* is used by Fernald (1942, 1950) and in this paper), this entity becomes var. *tonsa* Fern. But for those (e.g. Mackenzie, 1931–1935, 1940; Voss, 1972b) who recognize *C. rugosperma* Mack. to be the true *C. umbellata* Schkuhr ex Willd., then this entity, when treated as a variety, becomes *C. rugosperma* var. *tonsa* (Fern.) E. Voss. See comments under *C. abdita* and *C. umbellata*.

C. torreyi Tuckerm.

Virescentes

Thinly-wooded hillsides and coulees and, less commonly, prairies, mesic meadows, and sparsely-wooded river banks; infrequent to

occasional in the western half of the state, uncommon in the eastern half. Although most recent manuals (e.g. Fernald, 1950; Gleason and Cronquist, 1963; Hermann, 1970) give this species as ranging no farther eastward than Minnesota, it also occurs, albeit rarely, in extreme western Wisconsin (Read, 1976; Zimmerman, 1976).

C. tribuloides Wahlenb.

Ovales

Floodplain forests, woodland swales and pond margins and, less commonly, moist meadows, roadside ditches and embankments, and the margins of lakes and ponds; occasional to frequent in the eastern half of the state (particularly southward), infrequent in the western half. Like *C. projecta* (see comments under this species), *C. tribuloides* also produces shoots on old prostrate culms that become an effective means of vegetative reproduction (Weatherby, 1945).

C. trichocarpa Schkuhr

Paludosae

River banks, abandoned river channels and ox-bows, and wet prairies; known from scattered sites throughout the state, except in the north-central and northeastern portions, where it is unknown. Because in Minnesota fruiting material of this species often seems to be scarce or absent, it may well be more common in the state than our present collections suggest.

C. trisperma Dew.

Heleonastes

Wooded ombrotrophic bogs, wooded oligotrophic and mesotrophic "bogs", and conifer swamps; frequent to common in areas 1, 2, 3, occasional in 4, uncommon in the northern portion of 5. Clearly one of the most frequently-occurring carices in wooded "bogs" in the northern half of the state. In areas 4 and 5, it is mostly restricted to tamarack swamps. In the Red Lake Peatland, where it is often a dominant species, this plant occurs in forested ombrotrophic bogs and on wooded poor- and rich-fen islands (Glaser *et al.*, 1981; Wheeler and Glaser, 1982; Wheeler *et al.*, 1983).

C. tuckermanii Dew.

Vesicariae

Conifer and mixed conifer-hardwood swamps, alder swamps, floodplain forests, woodland swales and pond margins, abandoned river channels and ox-bows and, less commonly, wet meadows; occasional to frequent in areas 1, 2, 3, 4, uncommon in 5. See comments under *C. crinita*.

C. typhina Michx. *Squarrosae*

Floodplain forests of large rivers, especially the Mississippi and St. Croix rivers (Wheeler, 1979); very infrequent in areas 5, 6, 7. In the extreme southeastern corner of the state, this species is often associated with *C. muskingumensis* and *C. grayi* and, more rarely, with *C. davisii*.

C. umbellata Willd. *Montanae*

Margins of pine forests, sand barrens, and sandy disturbed sites (e.g. sand and gravel pits, roadside shoulders and embankments, clear-cut and burned-over areas, railroad tracks, trails and paths); occasional in the eastern half of the state, infrequent in the western half. It is considered by Handel (1978a) to be a myrmecochore. Some workers (e.g. Mackenzie, 1931–1935, 1940; Voss, 1972b) call this entity *C. rugosperma* Mack. See comments under *C. abdita* and *C. tonsa*.

C. vaginata Tausch *Paniceae*

Wooded mesotrophic “bogs” and conifer swamps; occasional in areas 1, 2 and the northern portion of 3. Although frequenting “bogs” and swamps, this circumpolar species seems to be uncommon in upland peatlands in the state. The American plant is sometimes distinguished (e.g. Mackenzie, 1931–1935, 1940) from the Eurasian entity as *C. saltuensis* Bailey.

C. vesicaria L. *Vesicariae*

Wet meadows, marshes, margins of lakes and streams and, less commonly, wet ditches and “bog” and swamp borders; frequent in areas 1, 3, occasional in 2, 4, infrequent in 5, 6.

C. viridula Michx. *Extensae*

Peaty meadows and wet sandy margins of lakes and, less commonly, roadside ditches and the edges of rock pools; occasional in the northern half of the state, infrequent in the southern half. Best known from northwestern Minnesota, where it is locally abundant in wet meadows, particularly those dominated by *C. lasiocarpa*.

C. vulpinoidea Michx. *Multiflorae*

Moist to wet meadows, marshes, ditches, shrub-carrs, the margins of lakes and streams and, less commonly, swampy woods; frequent to common throughout the state. One of the most frequently-occurring sedges in roadside verges.

C. woodii Dew.*Panicaceae*

Locally abundant in rich deciduous woodlands; known from scattered sites in areas 3, 6, 7. Because the plant fruits very early (about mid-May and even earlier), it is easily overlooked at other times. Thus, it is probably more common in Minnesota than present collections suggest. It was first correctly reported for the state by Hartley (1966); an earlier, erroneous report (Moore and Tryon, 1946) was based on a specimen of *C. blanda*. Some workers (e.g. Gleason and Cronquist, 1963) treat this entity as *C. tetanica* Schkuhr var. *woodii* (Dew.) Wood.

C. xerantica Bailey*Ovales*

Known from bluff-tops bordering Watab Lake in northern Cook County (Butters and Abbe, 1953; Wheeler, 1983b). The isolated presence of *C. xerantica* in Cook County may indicate that the plant was more widespread in the state during the xerothermic period. However, because this species is known from stations in North Dakota (McGregor *et al.*, 1977) and Manitoba (Scoggan, 1957, 1978), its migration to Minnesota in more recent times is possible (Wheeler, 1983b). Presently, it appears to be very rare in the state.

DOUBTFUL AND EXCLUDED TAXA

Carex argyrantha Tuckerm.

Fernald (1950) and Scoggan (1978) included Minnesota within the range of *C. argyrantha*, apparently based on an earlier listing for the state by Moore and Tryon (1946). No specimen, however, has been seen to support its presence in the state. This taxon is known neither from Wisconsin (Zimmerman, personal communication) nor Manitoba (Scoggan, 1957, 1978) and, based on the distribution for the species given by Gleason and Cronquist (1963), it seems unlikely that it occurs in Minnesota.

Carex digitalis Willd.

Reported for Minnesota by Mackenzie (1931–1935), but no confirming specimen has been seen. It seems unlikely that this eastern species (ranging eastward from eastern Wisconsin) occurs in the state.

Carex lupuliformis Sartwell

Reported for Minnesota by Mackenzie (1931–1935), apparently based on an earlier report made by Sheldon (1894). Some recent

authors (Fernald, 1950; Gleason and Cronquist, 1963; Scoggan, 1978) have also included Minnesota within the range of the species. Owing to the lack of a confirming specimen, it must be excluded from the flora at the present time. But because the species occurs in Wisconsin (Read, 1976) and Iowa (Gilly, 1946), it is not improbable that it does extend into southeastern Minnesota.

Carex panicea L.

This European species was reported for Minnesota by Fernald (1950) and Hultén (1958), apparently based on an earlier listing for the state by Moore and Tryon (1946). No confirming specimen for Minnesota has been seen. Although this species is now naturalized along the eastern coast of North America (Fernald, 1950; Hultén, 1958), its occurrence in Minnesota seems highly unlikely.

Carex picta Steud.

A specimen of *C. picta* collected by J. A. Stevenson in 1917 (June 22) and purported to be from Beltrami County (near Bemidji) is in the University of Minnesota Herbarium. On the same herbarium sheet is a specimen of *C. willdenovii* Willd., also otherwise unknown from Minnesota. Both *C. picta* and *C. willdenovii* were reported from Minnesota by Fernald (1950), apparently based on the Moore and Tryon (1946) list. Neither species is known from Wisconsin (Zimmerman, personal communication) or Iowa (Gilly, 1946). Because both of these carices would be so far from the ranges given for them by some workers (e.g. Gleason and Cronquist, 1963), it seems best to tentatively reject them both as part of the Minnesota flora and to suggest confusion in place record labeling. According to Gleason and Cronquist (1963), *C. picta* ranges from southern Indiana to Alabama and Louisiana, and *C. willdenovii* from Massachusetts to Ontario and southern Indiana then south to Georgia and Texas.

Carex squarrosa L.

An immature specimen of *C. squarrosa* collected by Rev. Z. L. Chandonnet (no date or number given) and purported to be from Mahnomen County ("White Earth Reservation, Fish Lake") is in the University of Minnesota Herbarium. Although reported from Minnesota by various workers (e.g. Moore and Tryon, 1946; Fernald, 1950; McGregor *et al.*, 1977), the locality is so far out of range as to be suspicious. Therefore, we tentatively reject it from the

Minnesota flora, awaiting further verification. The species is not known from Wisconsin (Zimmerman, personal communication), and it is apparently restricted to the southern one third of Iowa (Gilly, 1946).

Carex suberecta (Olney) Britton

Reported for Minnesota by Mackenzie (1931–1935) and others (Fernald, 1950; Gleason and Cronquist, 1963), but no confirming specimen has been seen. Because this species is known from Wisconsin (Read, 1976) and Iowa (Gilly, 1946), it may well occur in southern Minnesota.

Carex torta Tuckerm.

Mackenzie (1931–1935) reported *C. torta* from Minnesota apparently on the basis of a collection (MIN) made in Houston County (Winnebago Valley) by H. L. Lyon in 1899 (June 8). Some recent authors (Moore and Tryon, 1946; Fernald, 1950; Gleason and Cronquist, 1963; Scoggan, 1987) have also included Minnesota within the range of the species, apparently based on Mackenzie's report. However, the specimen upon which the original report was based is actually *C. emoryi* Dew.

Carex willdenovii Willd.

It seems best to reject *C. willdenovii* as part of the Minnesota flora. For specific details see under *C. picta* above.

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DISTRIBUTION
MAPS OF
142
MINNESOTA
CARICES



CAREX ABDITA



CAREX ADUSTA



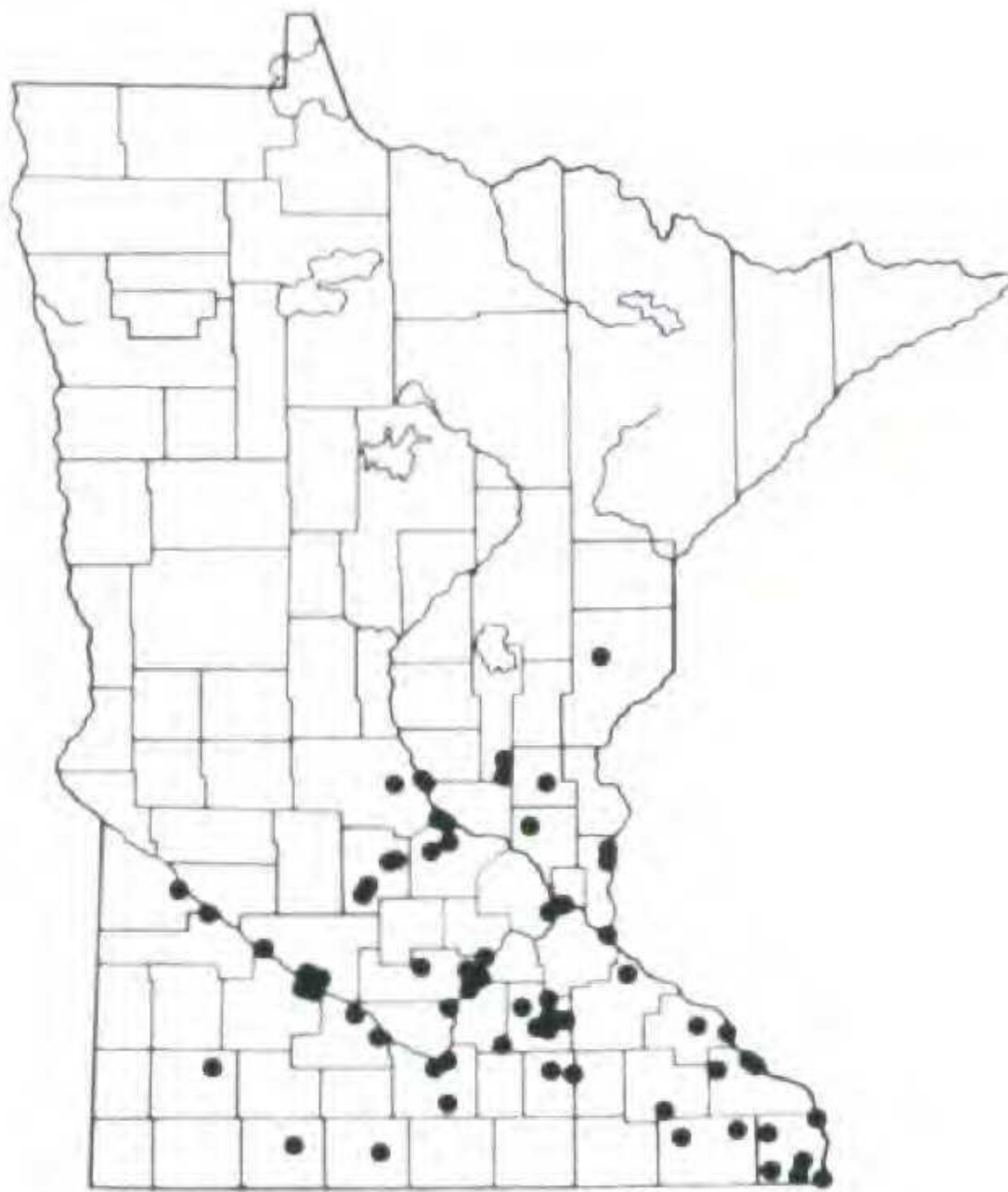
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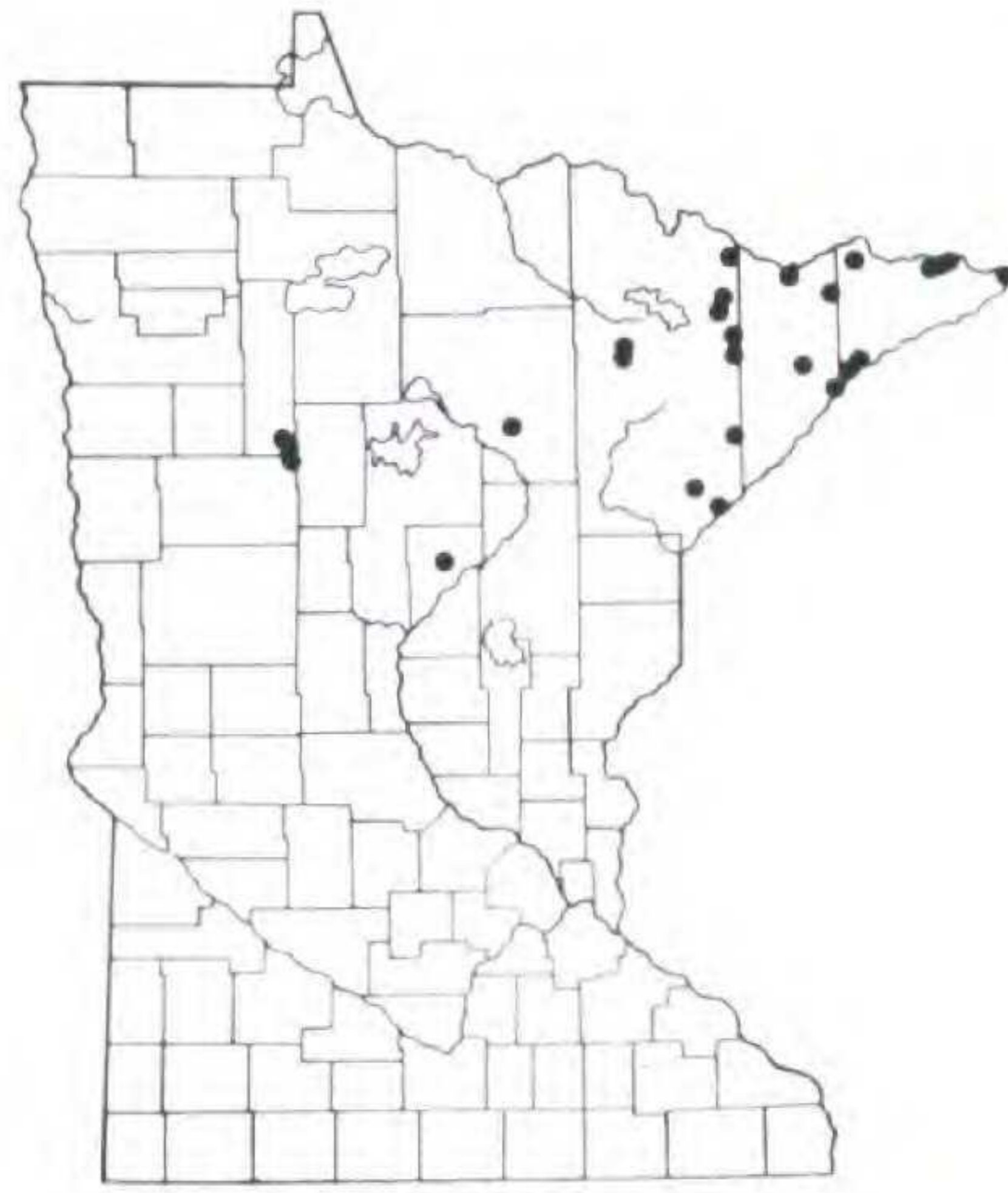
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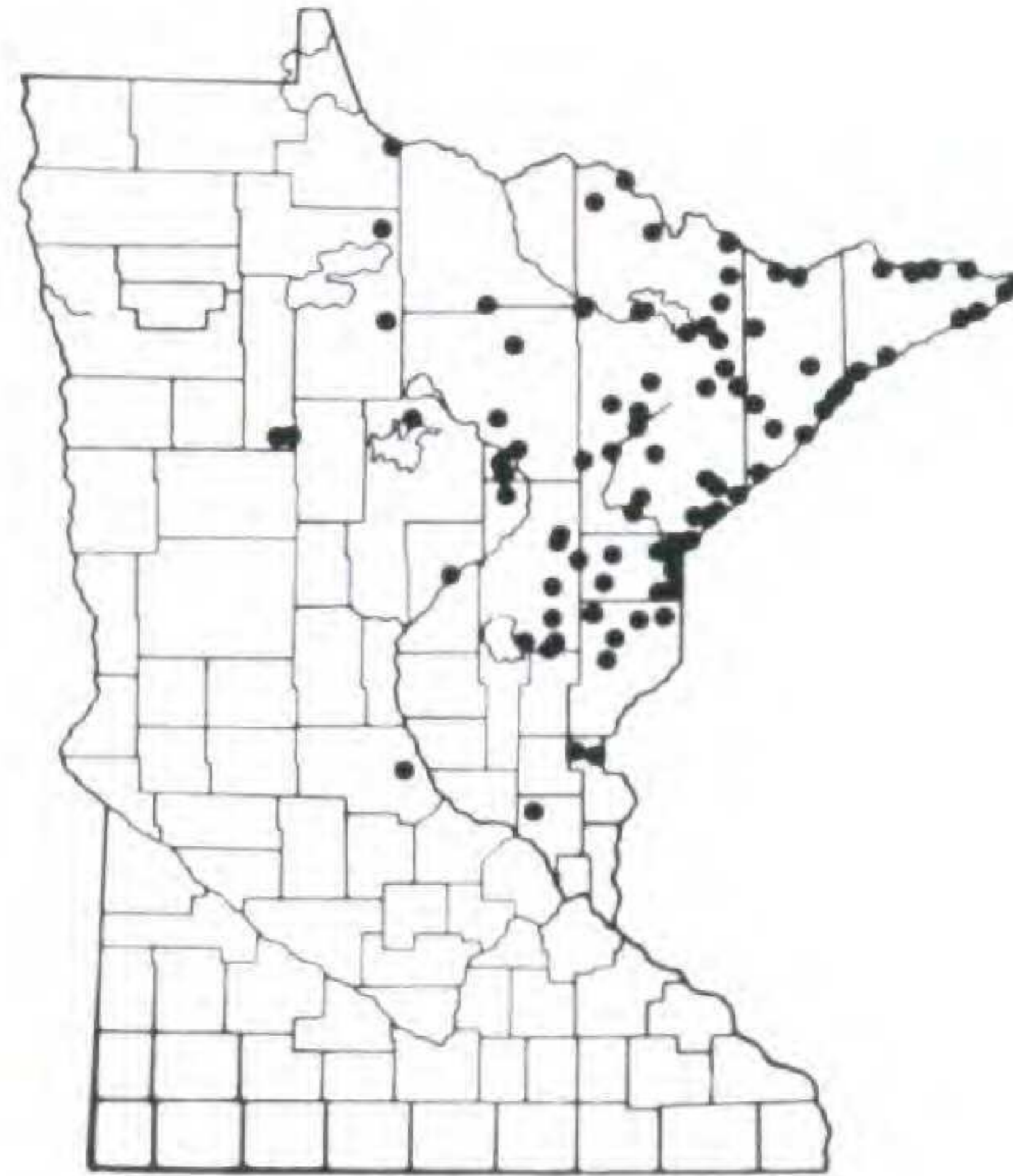
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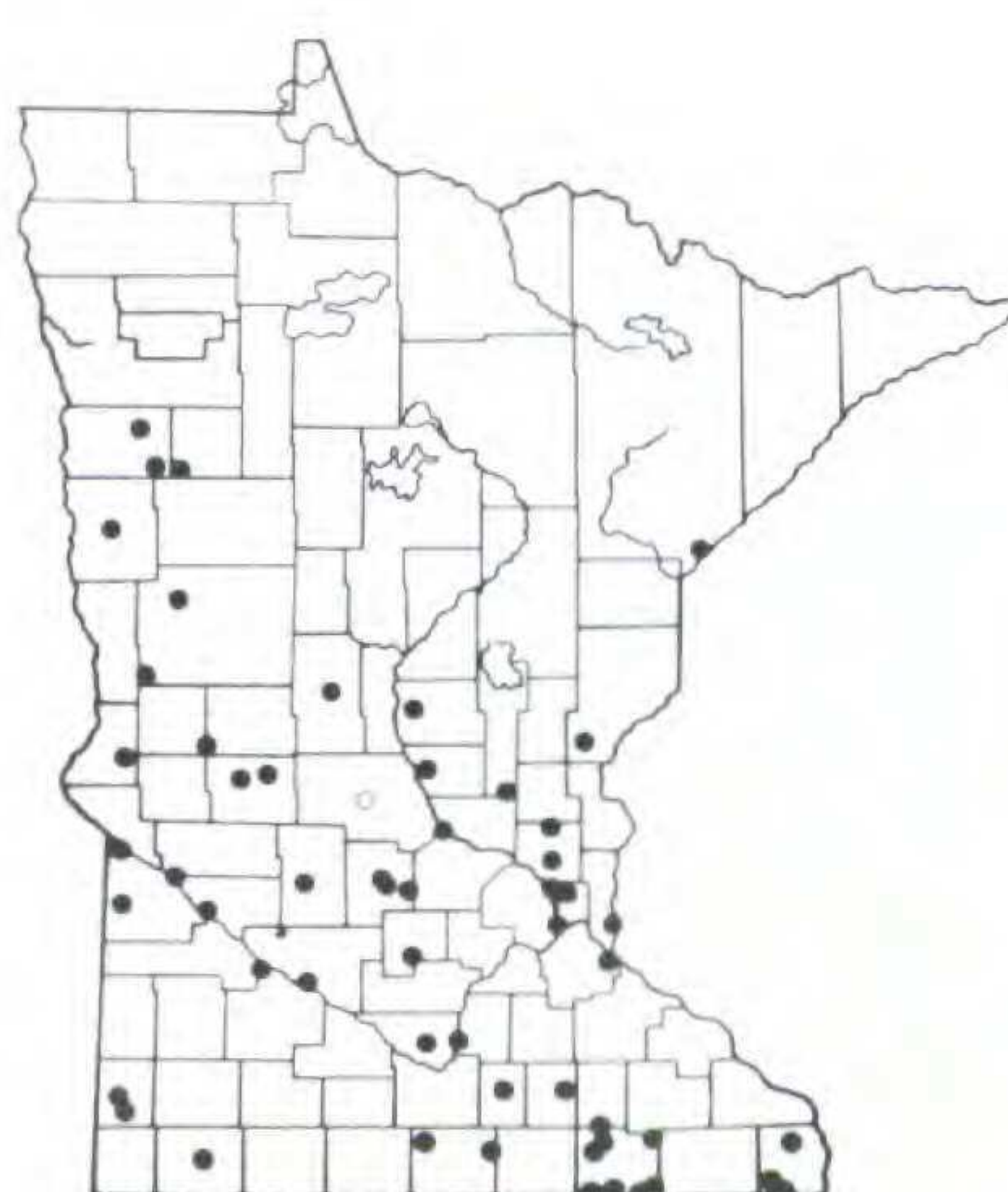
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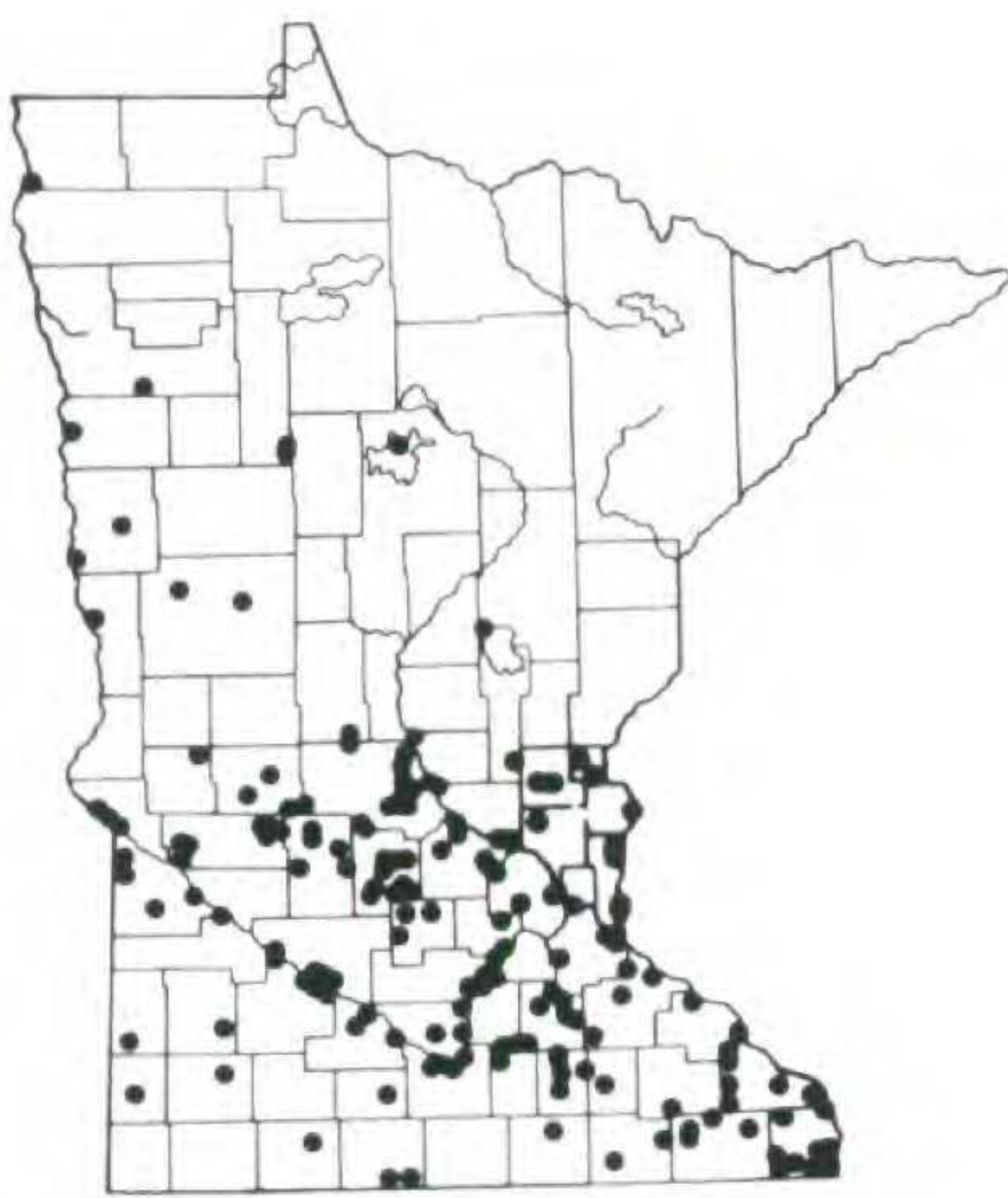
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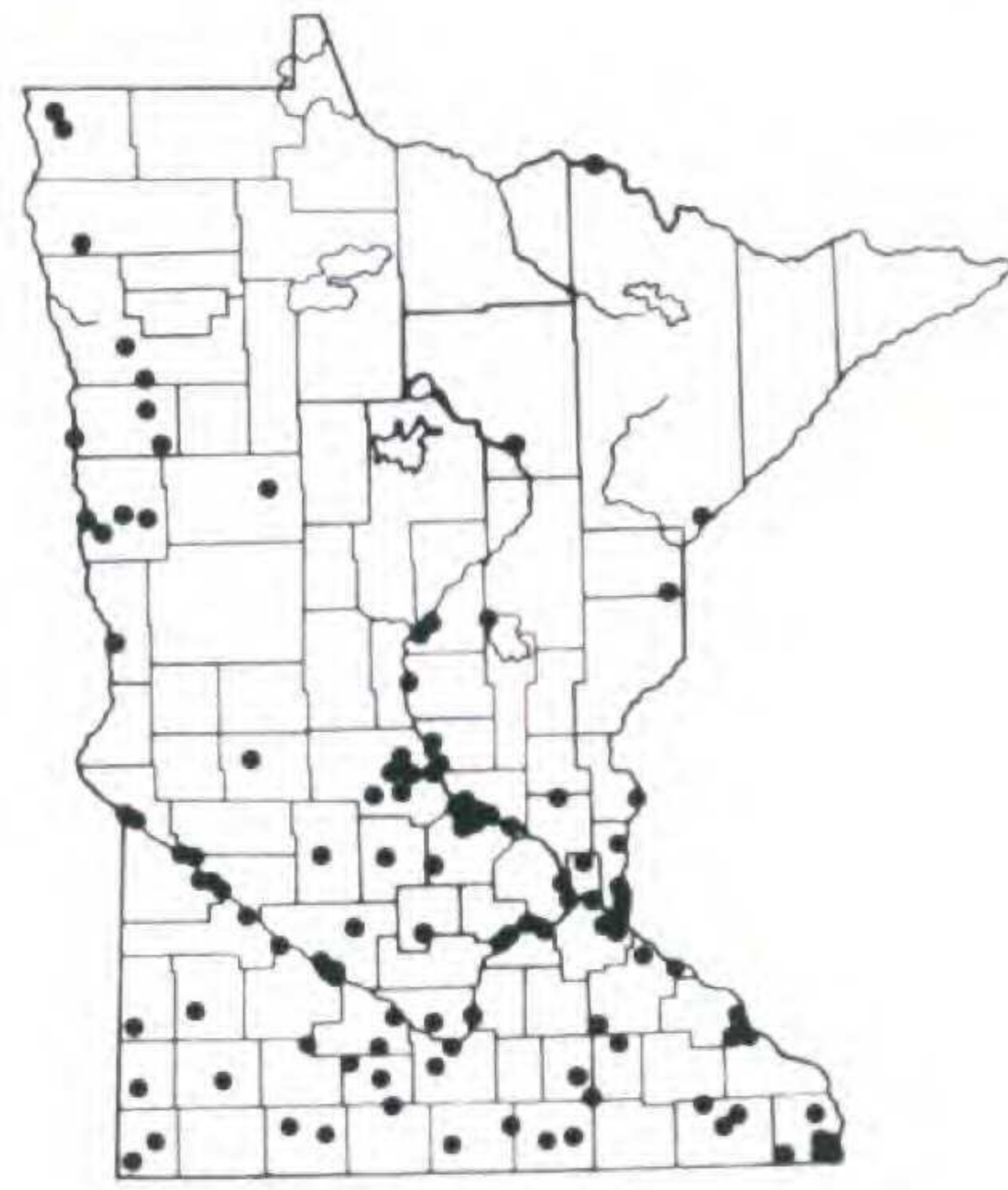
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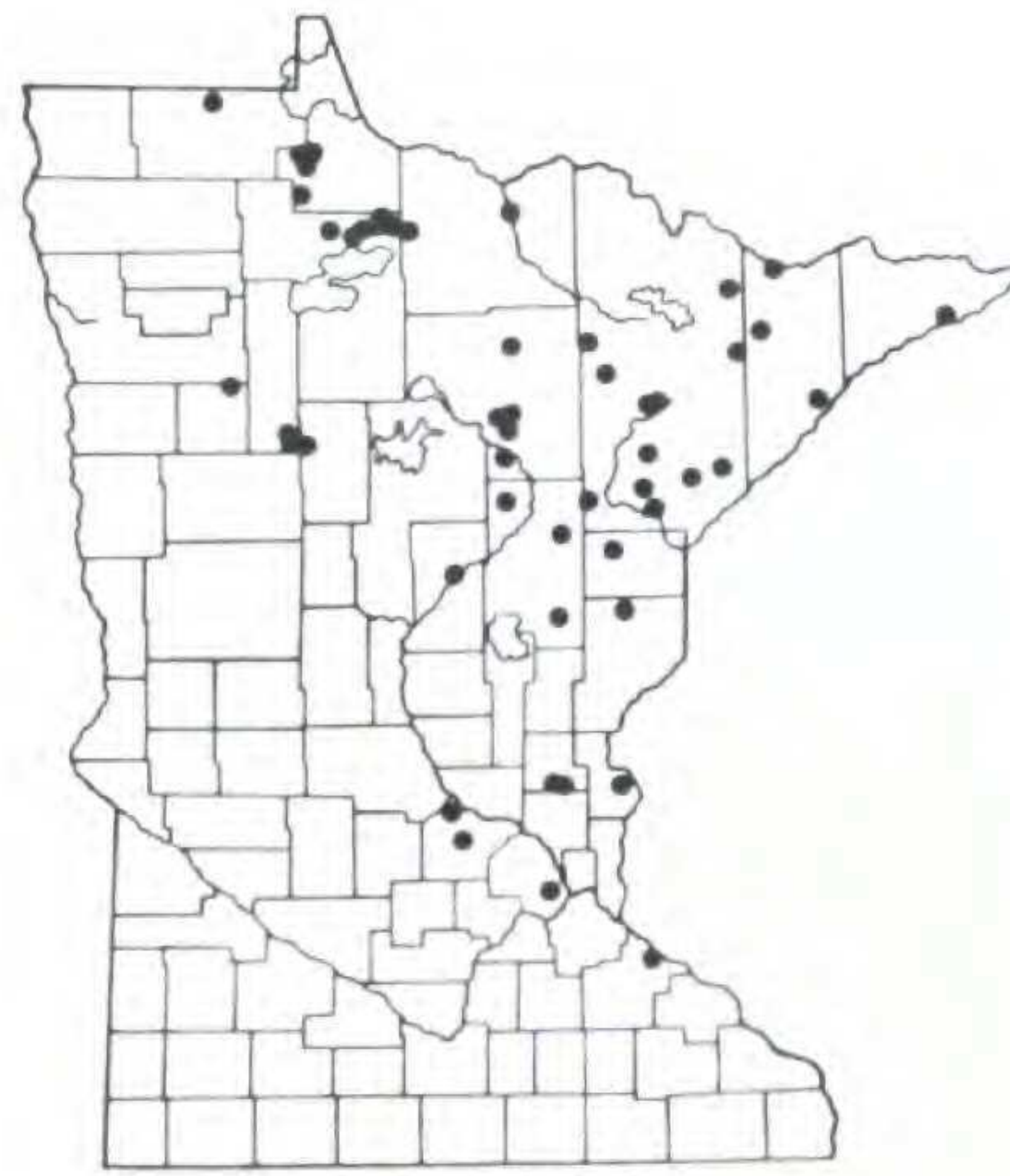
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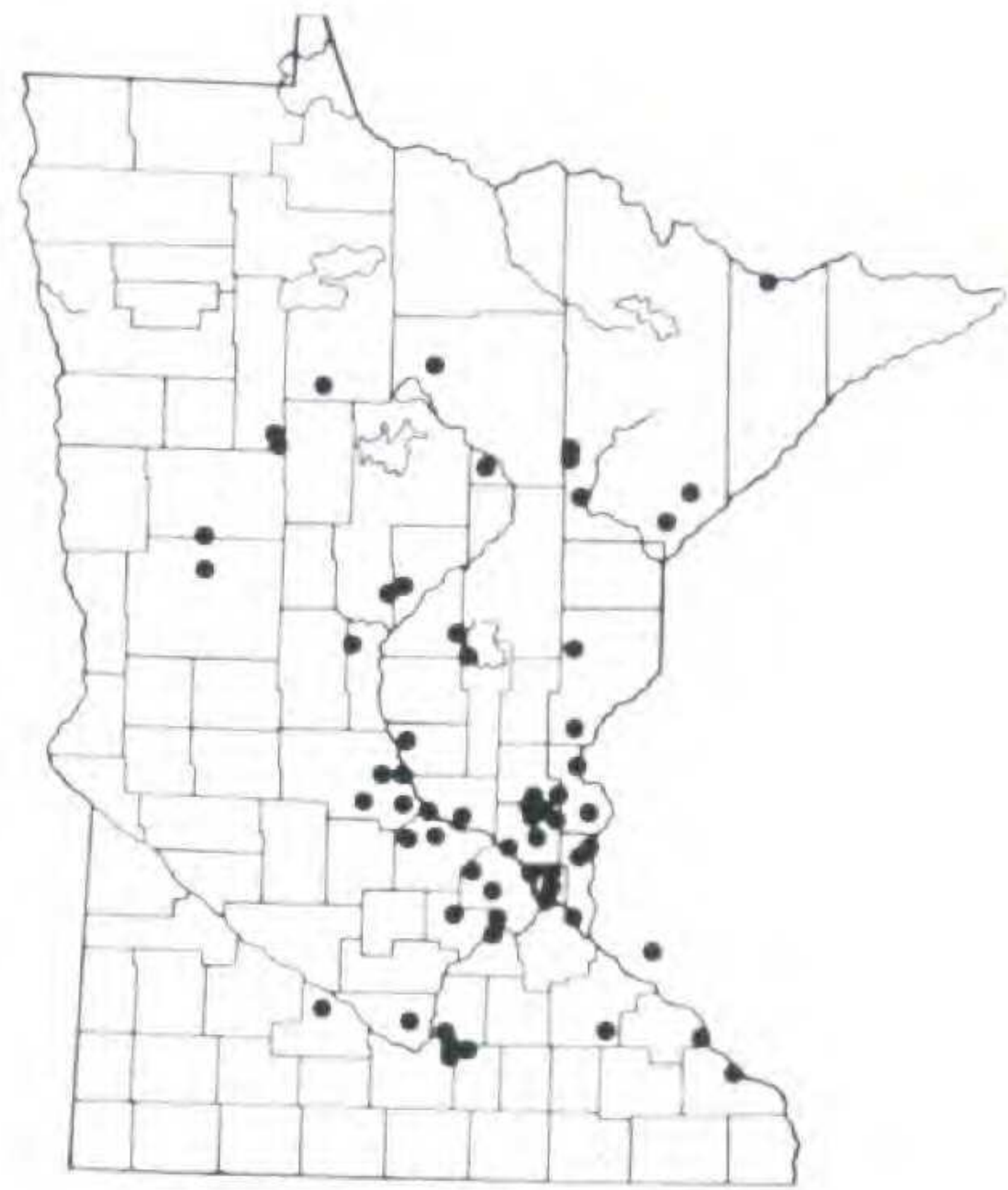
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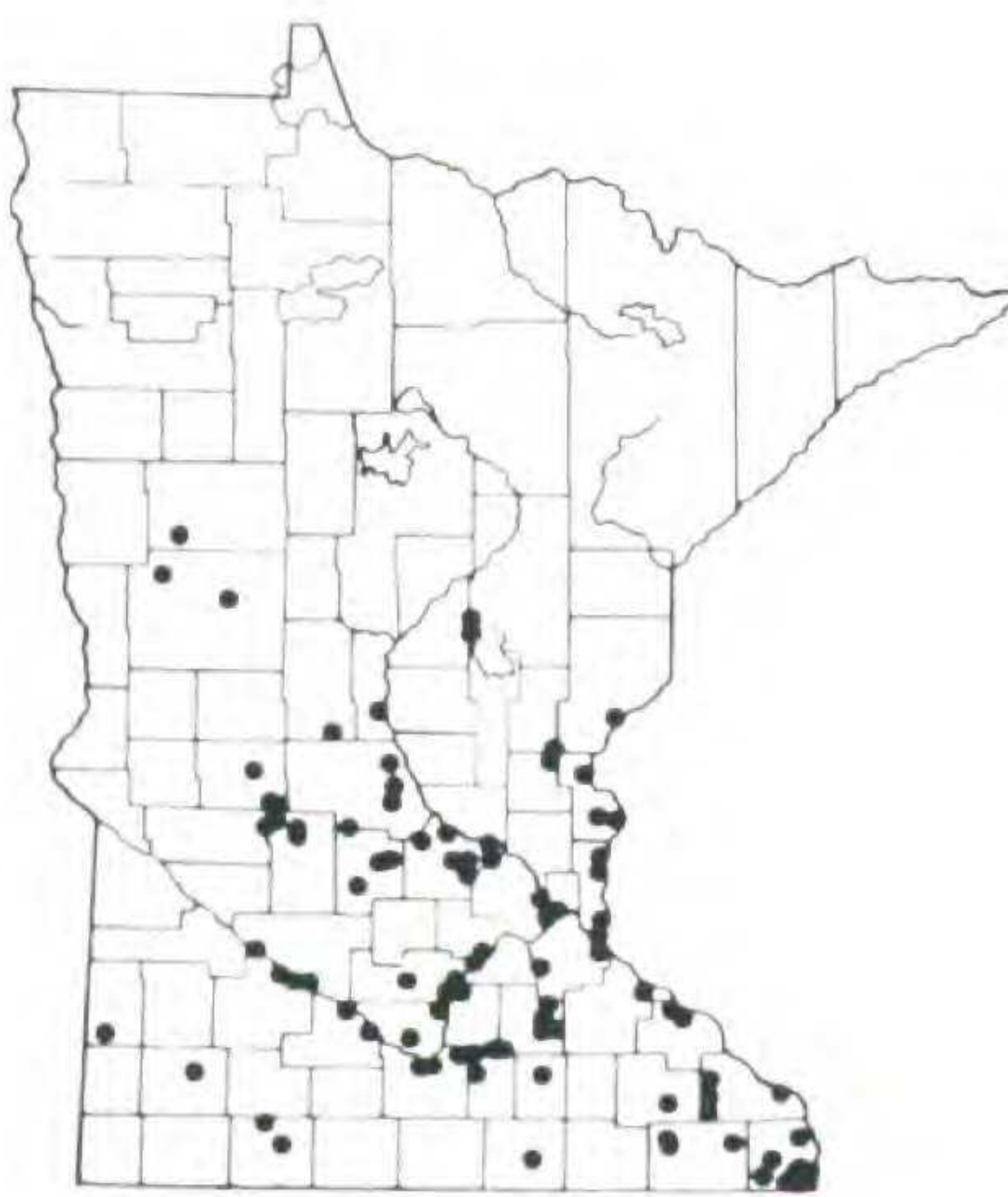
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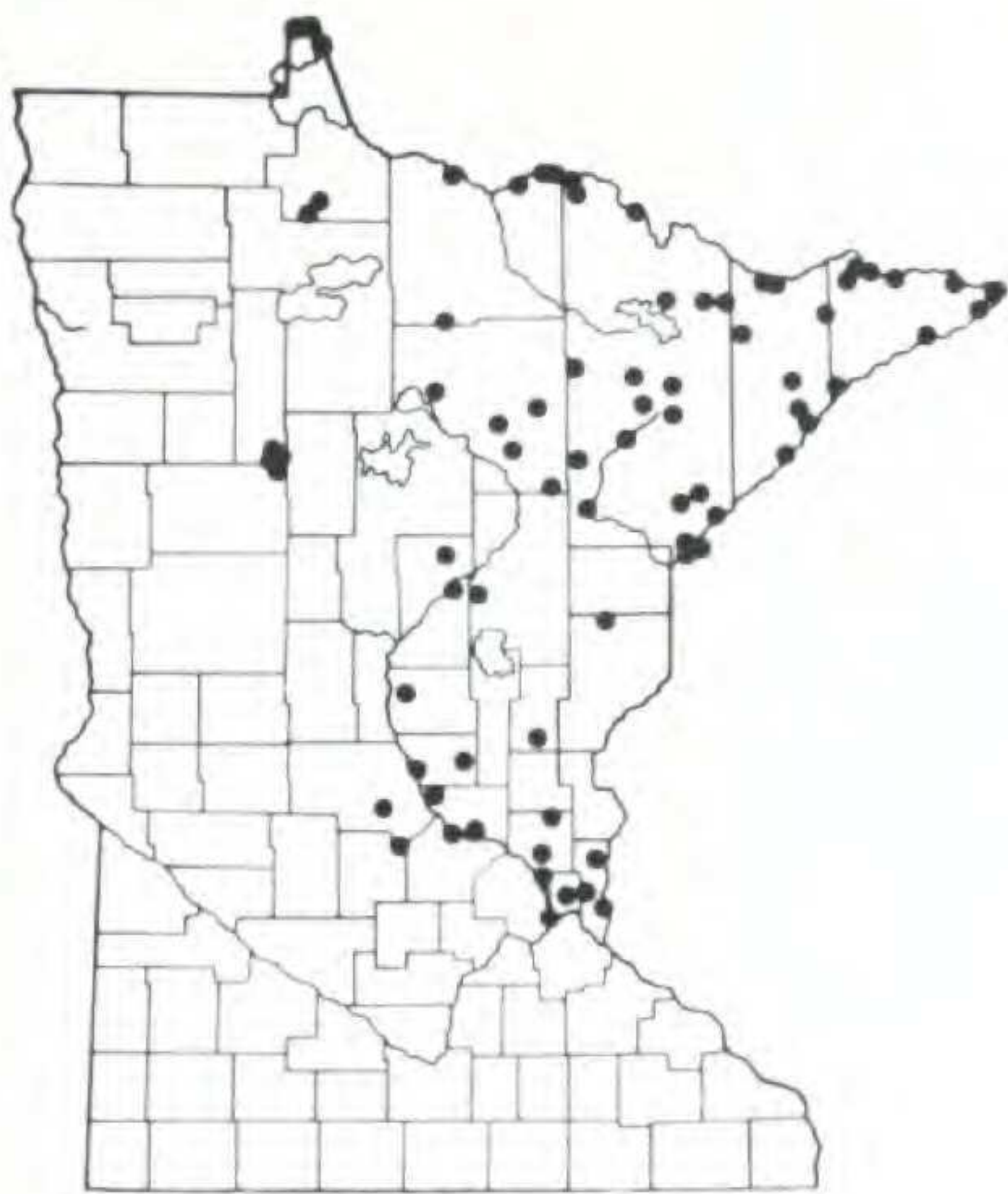
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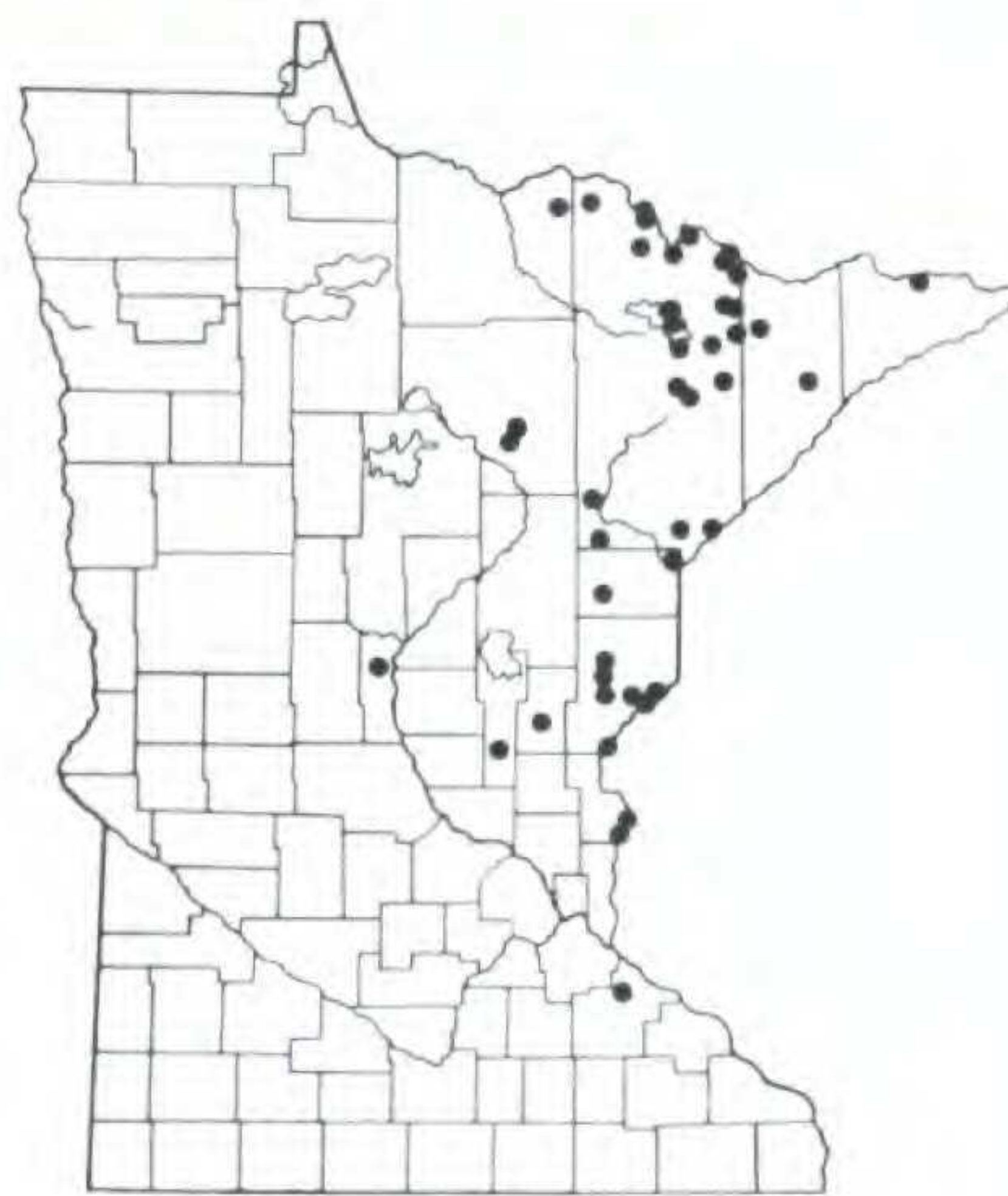
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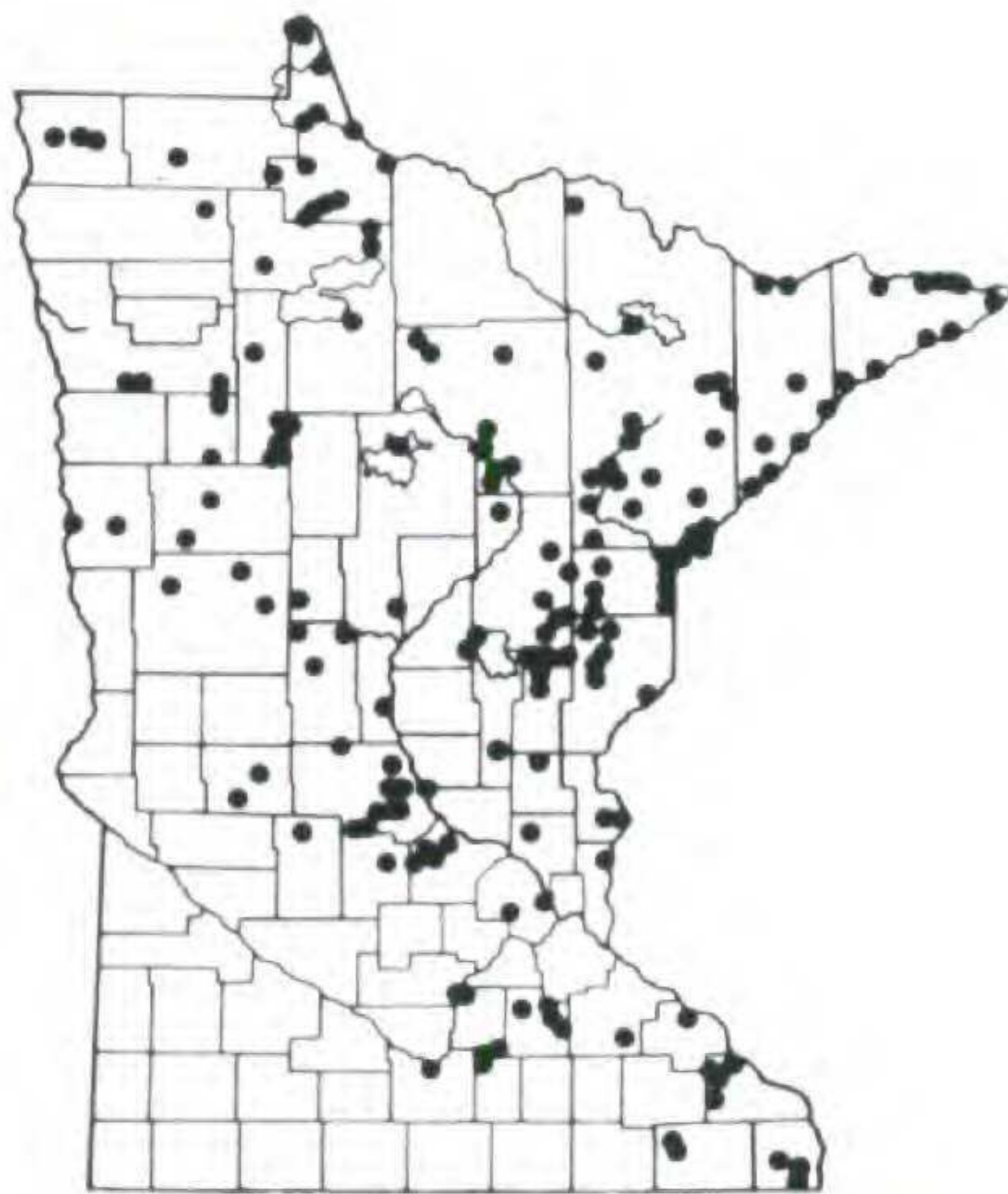
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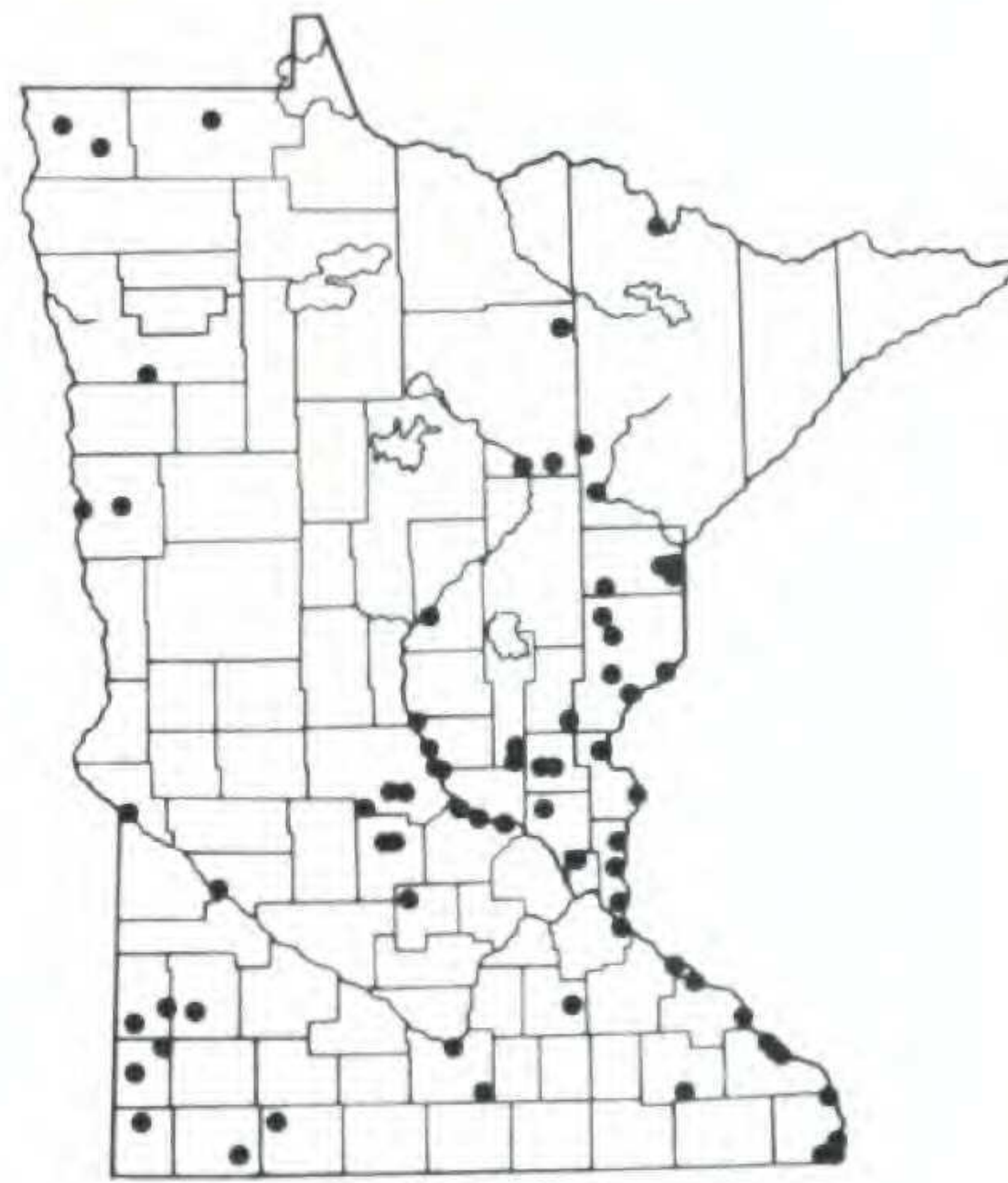
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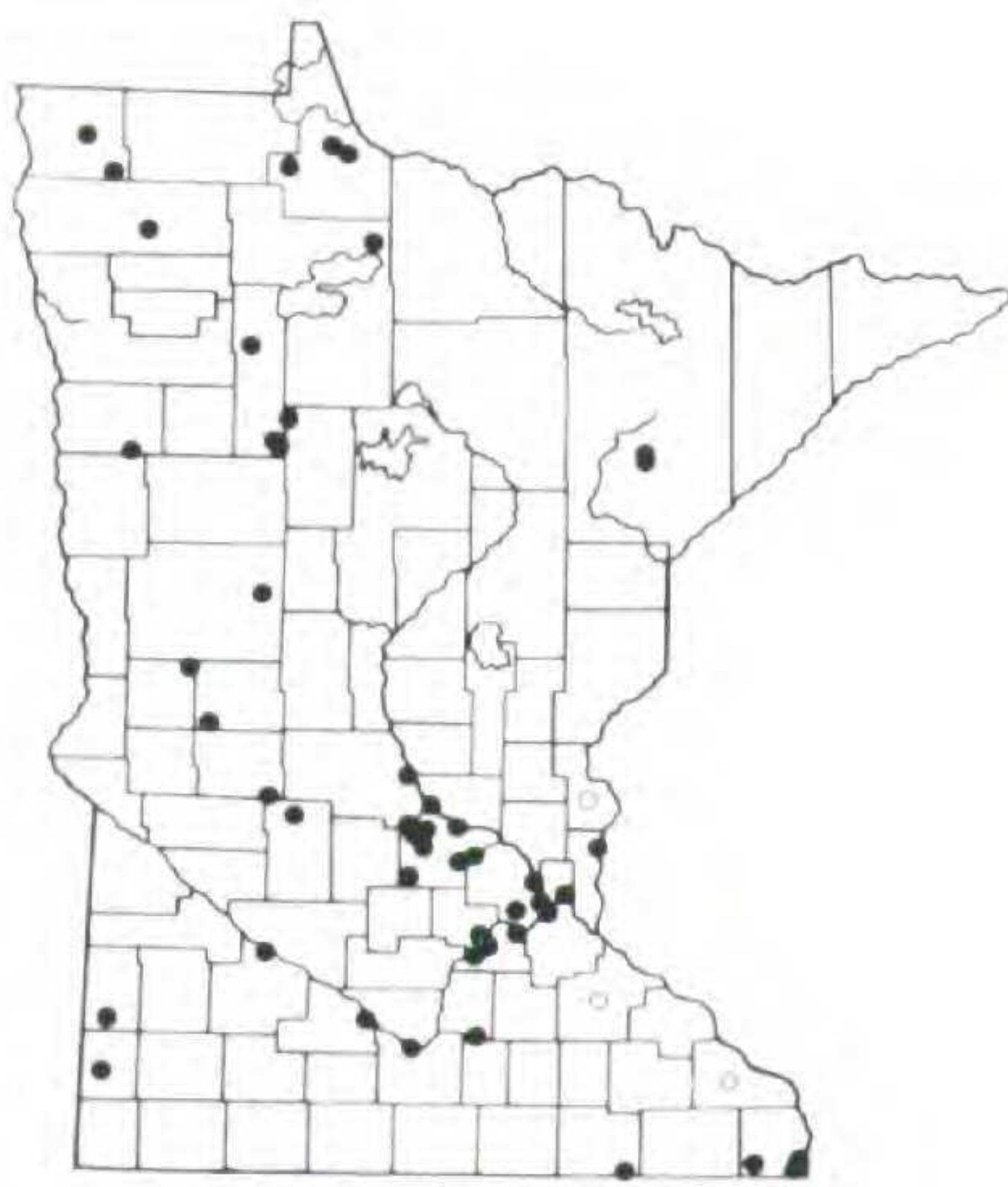
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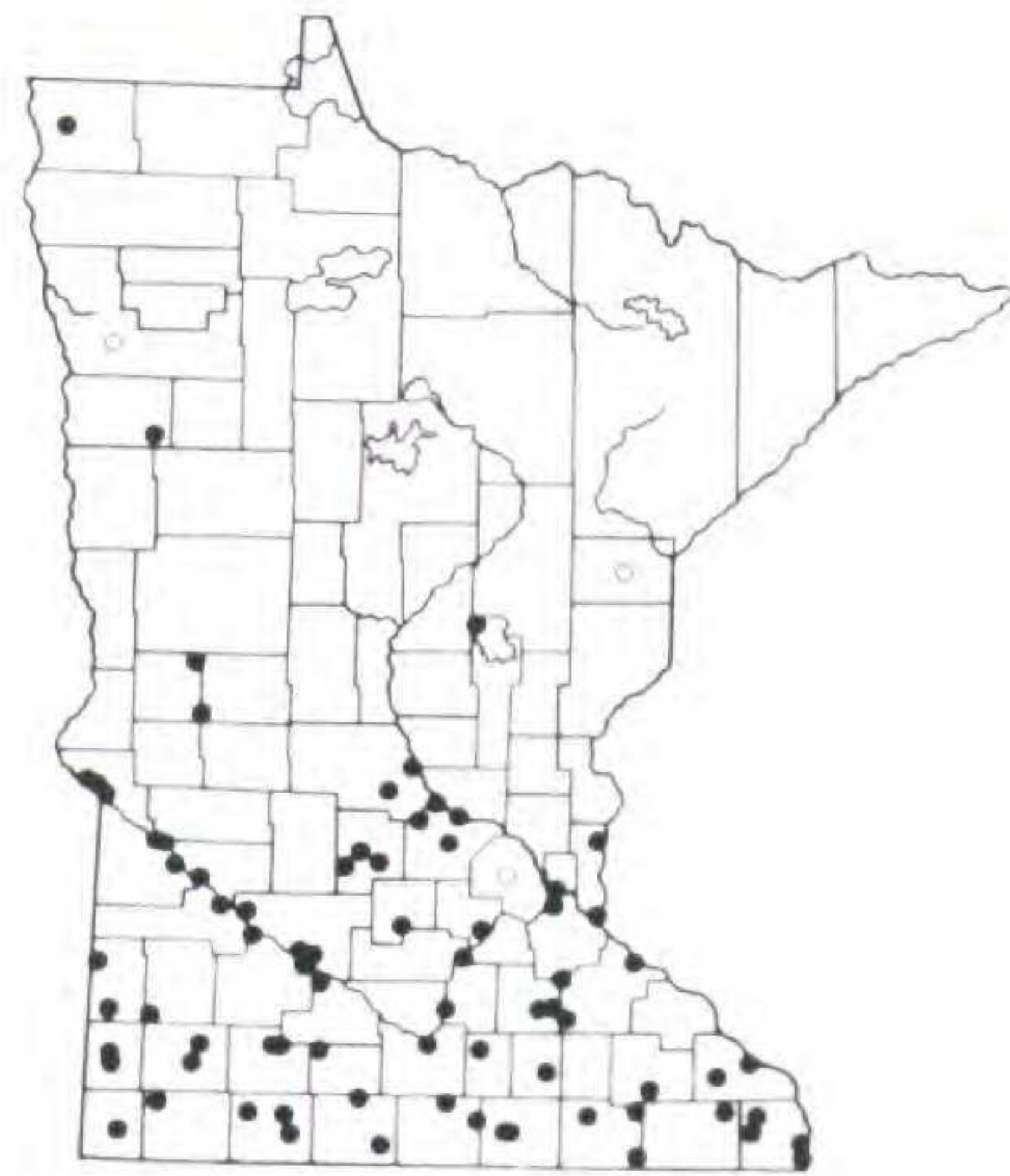
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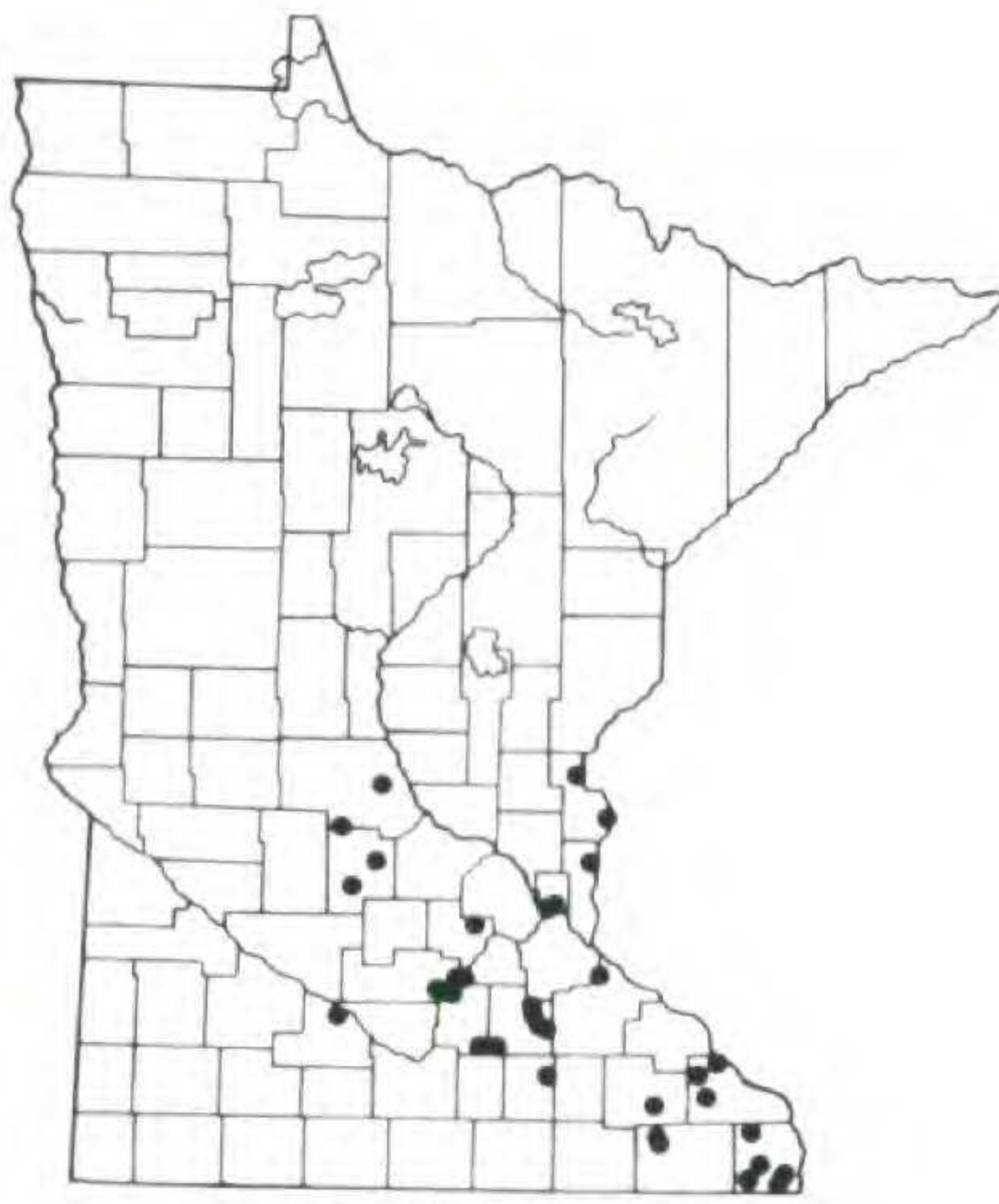
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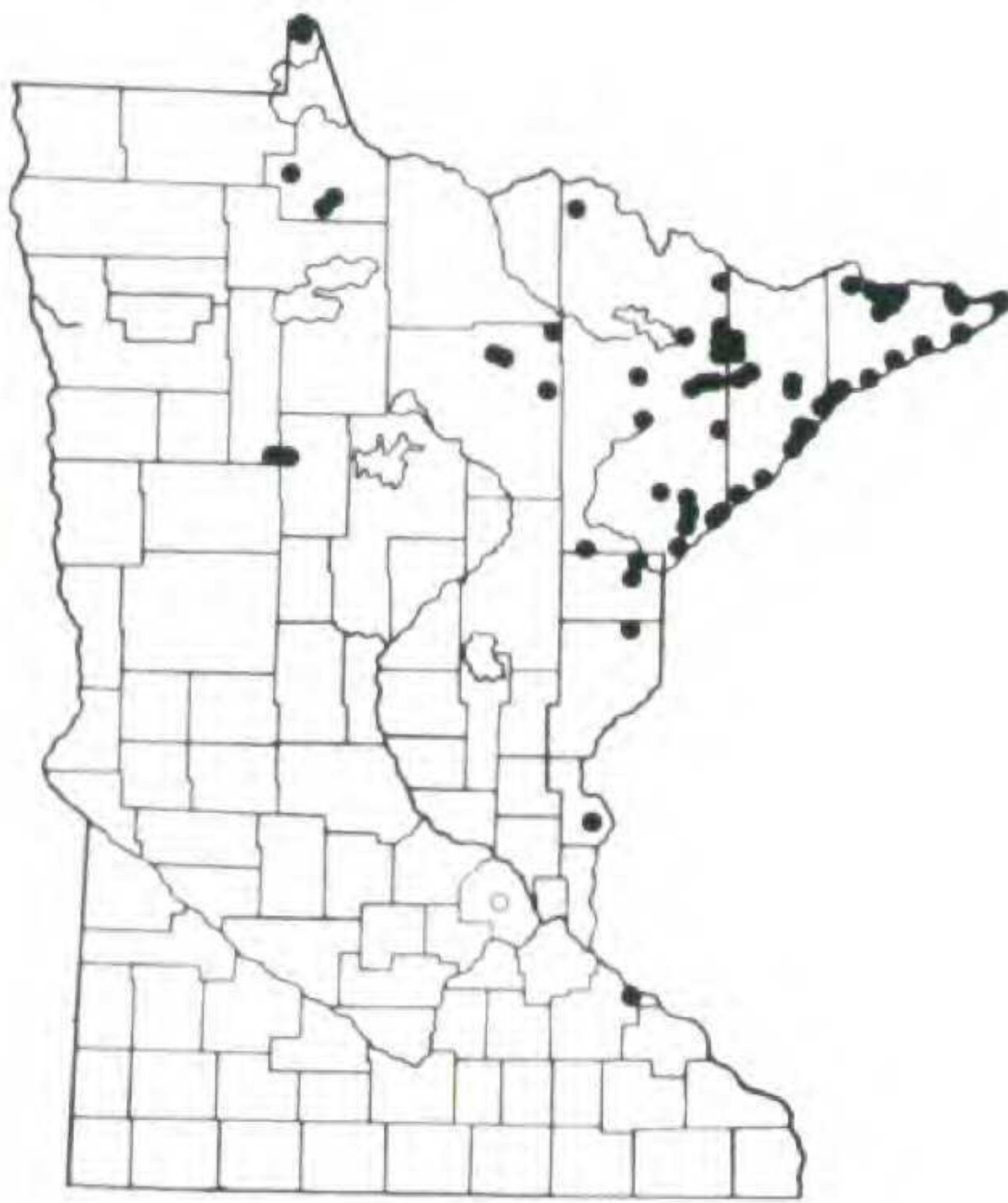
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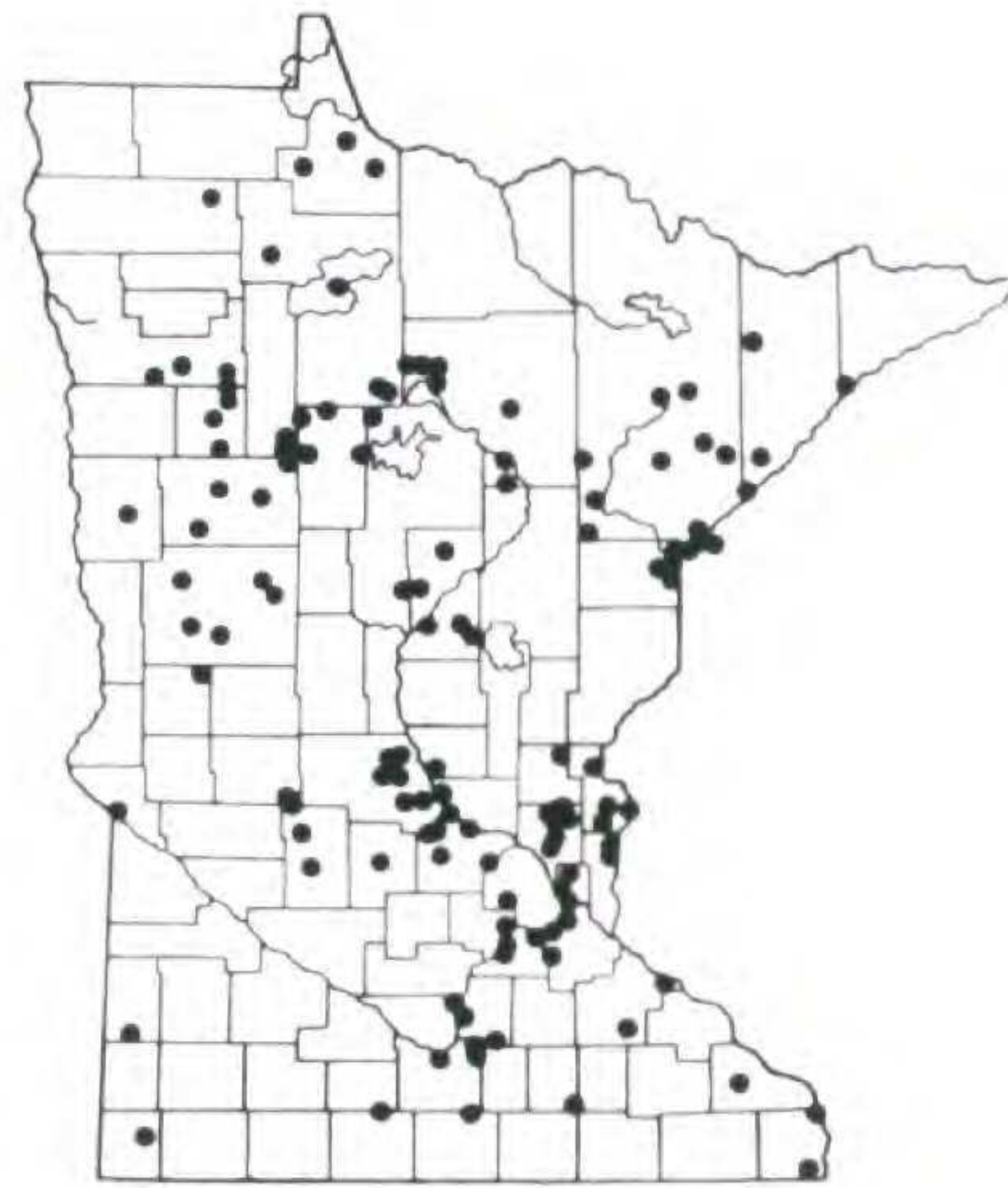
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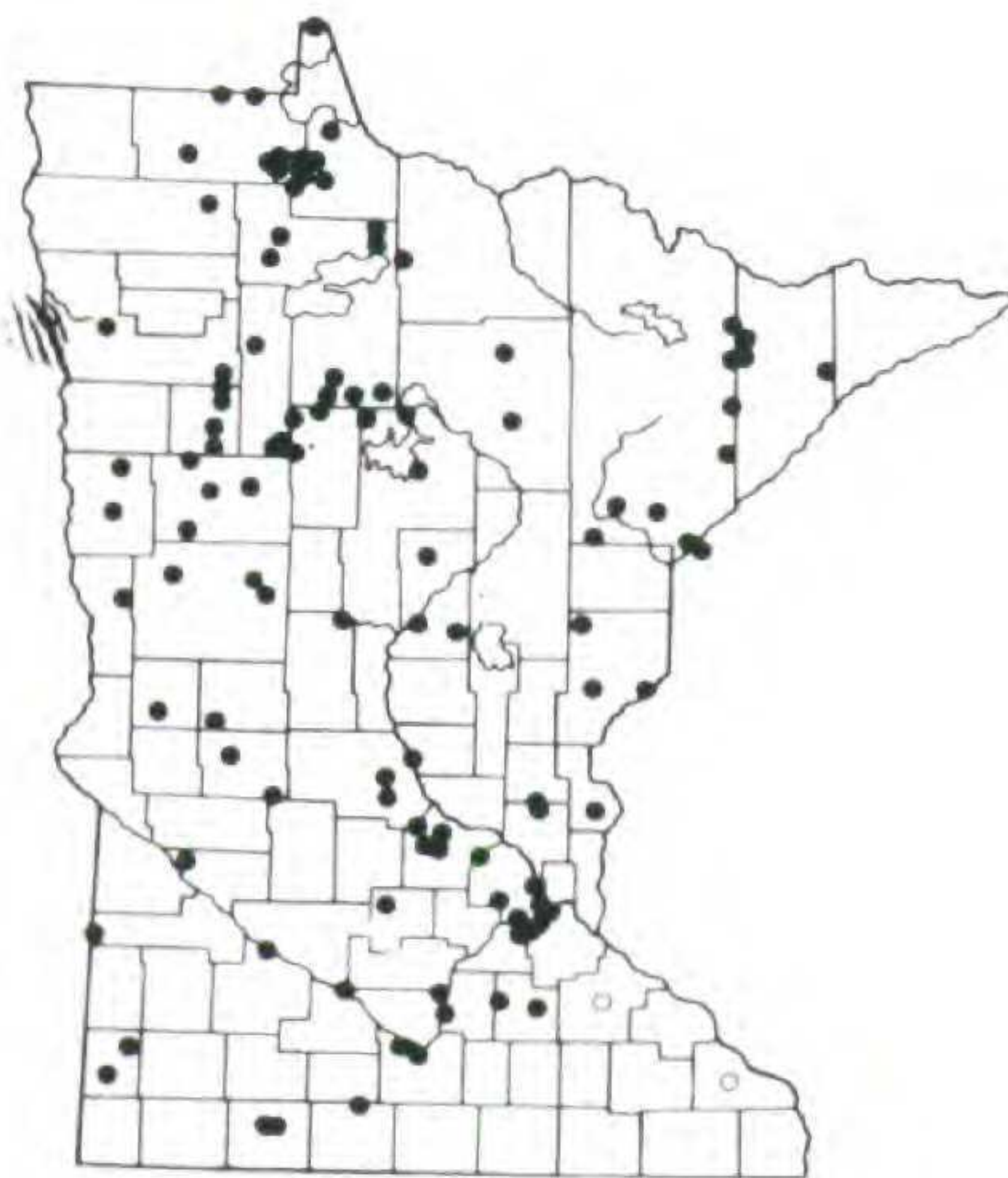
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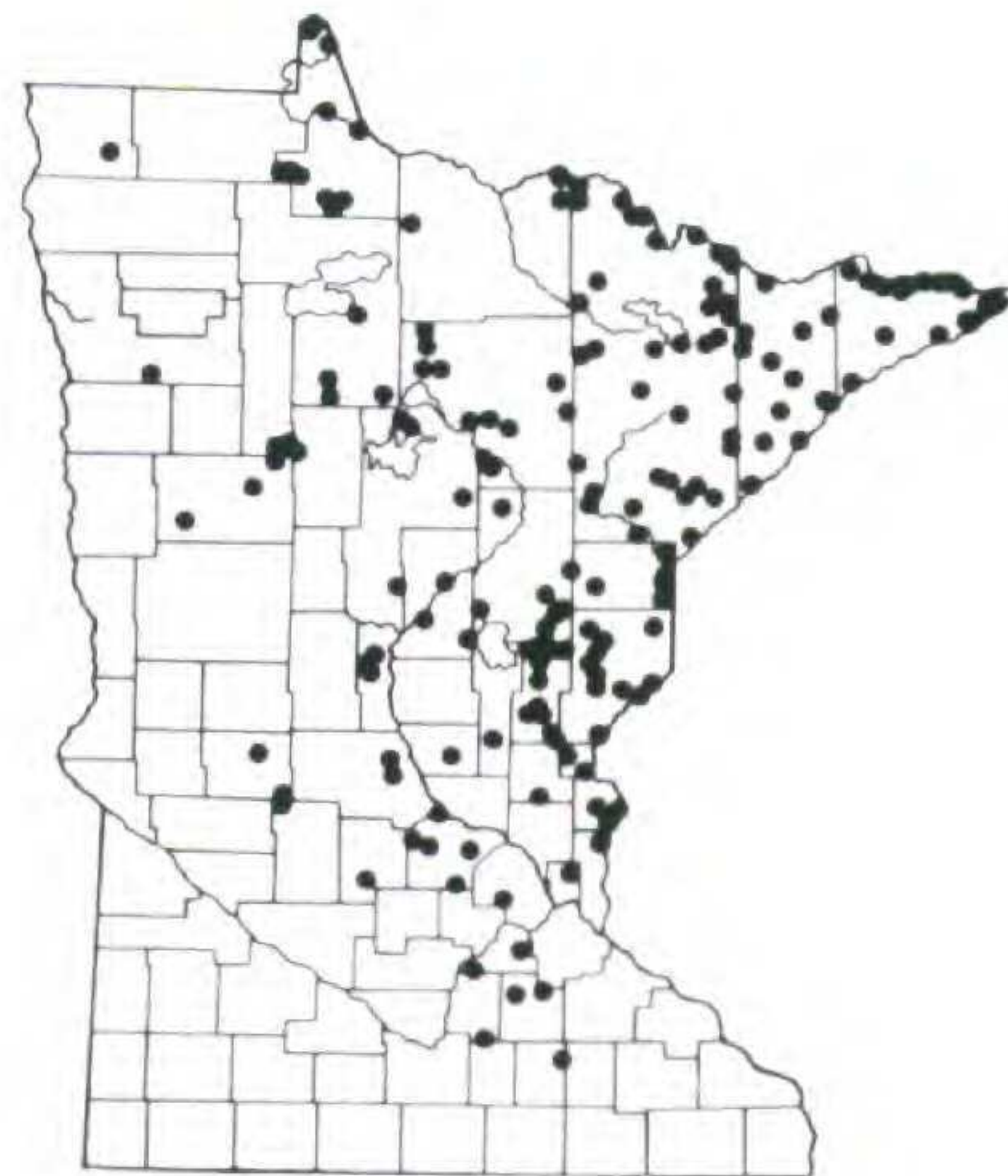
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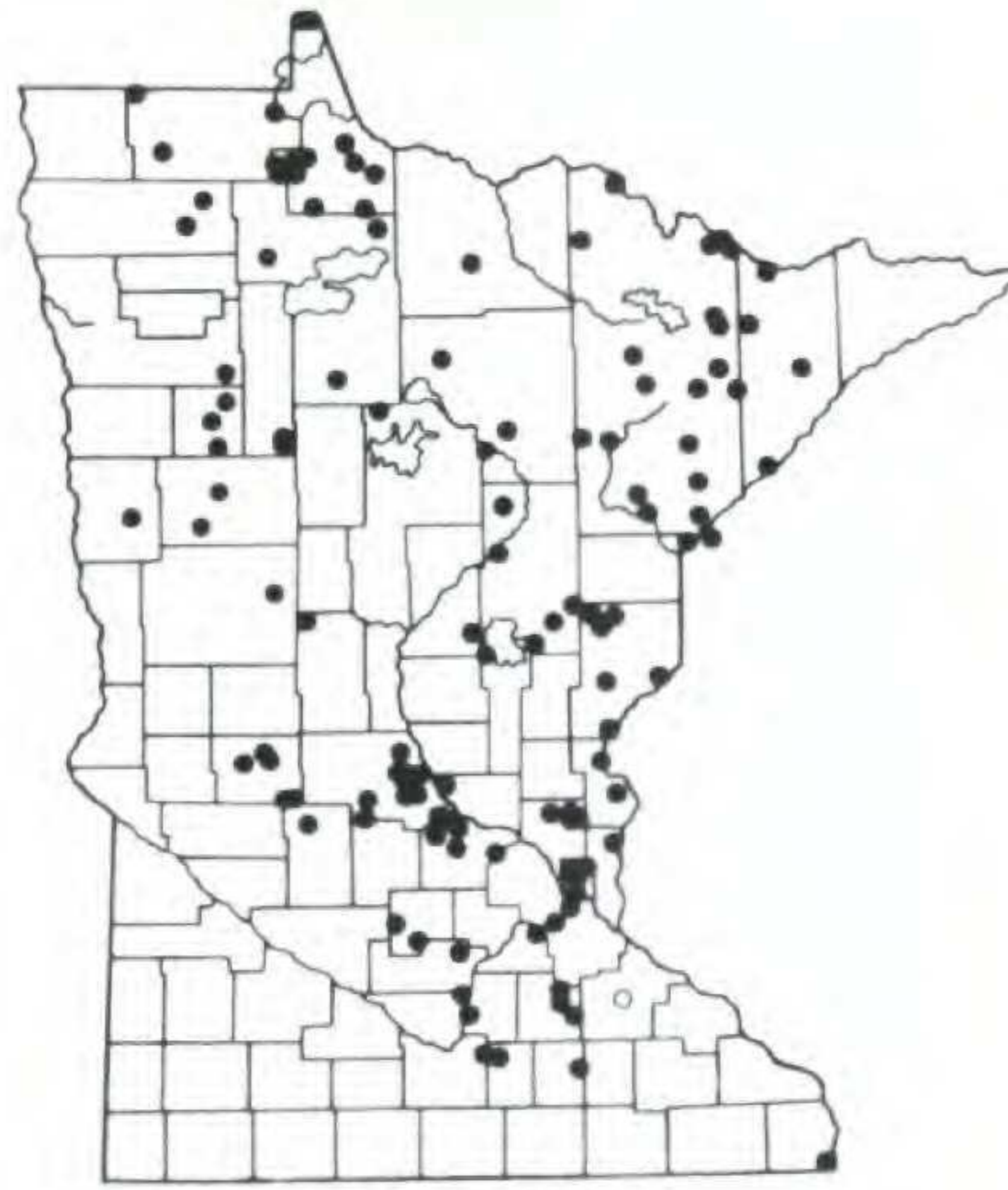
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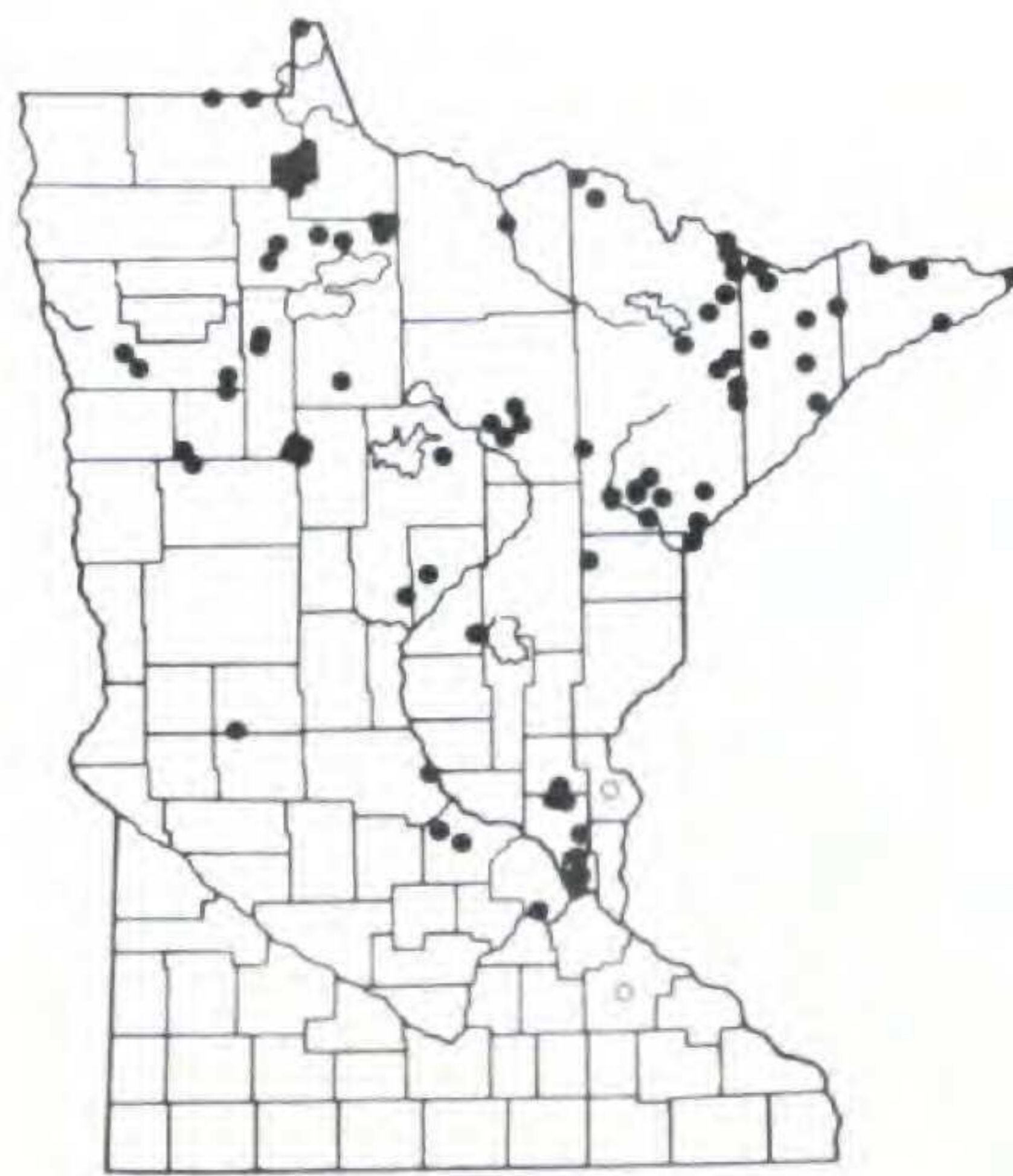
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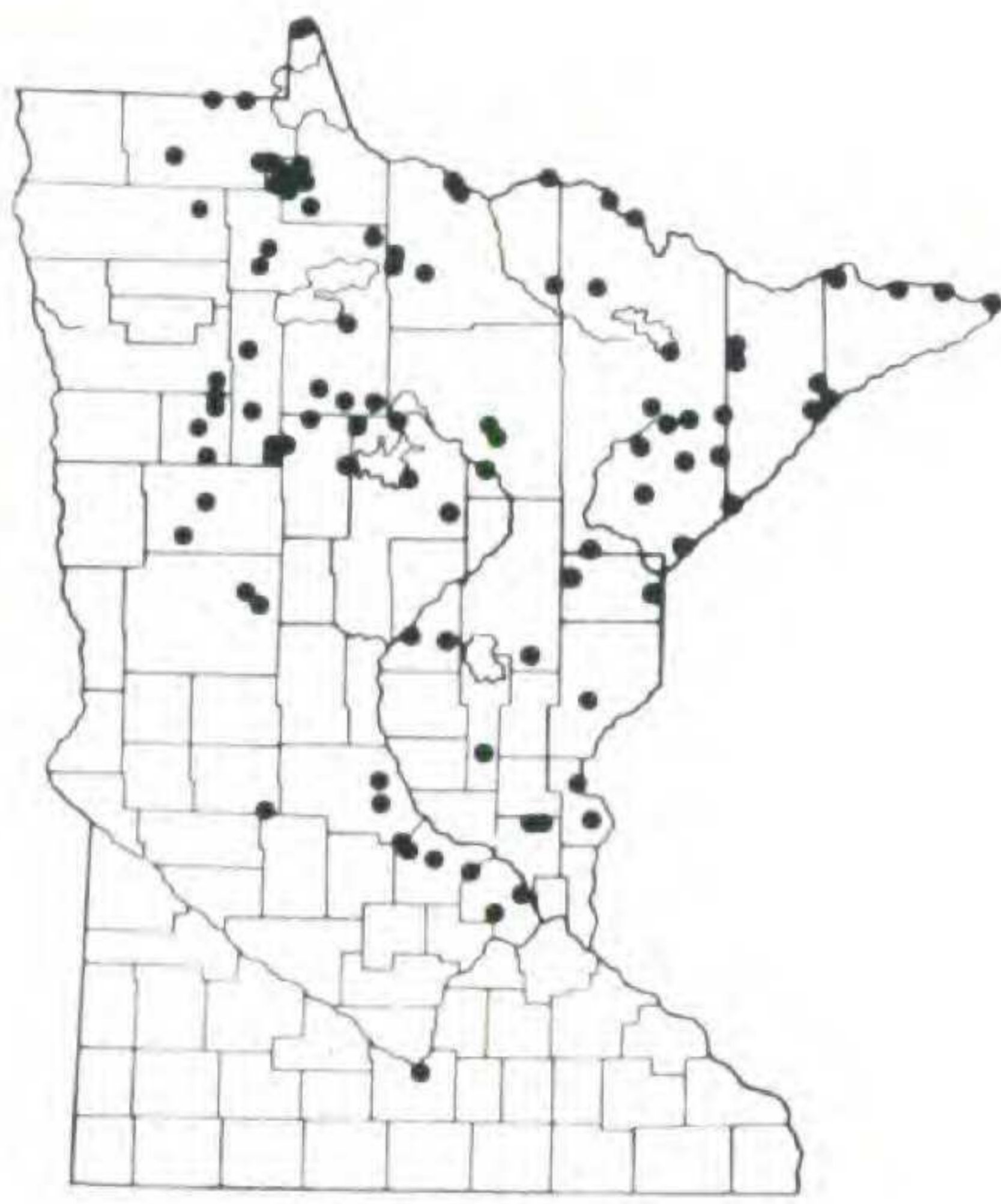
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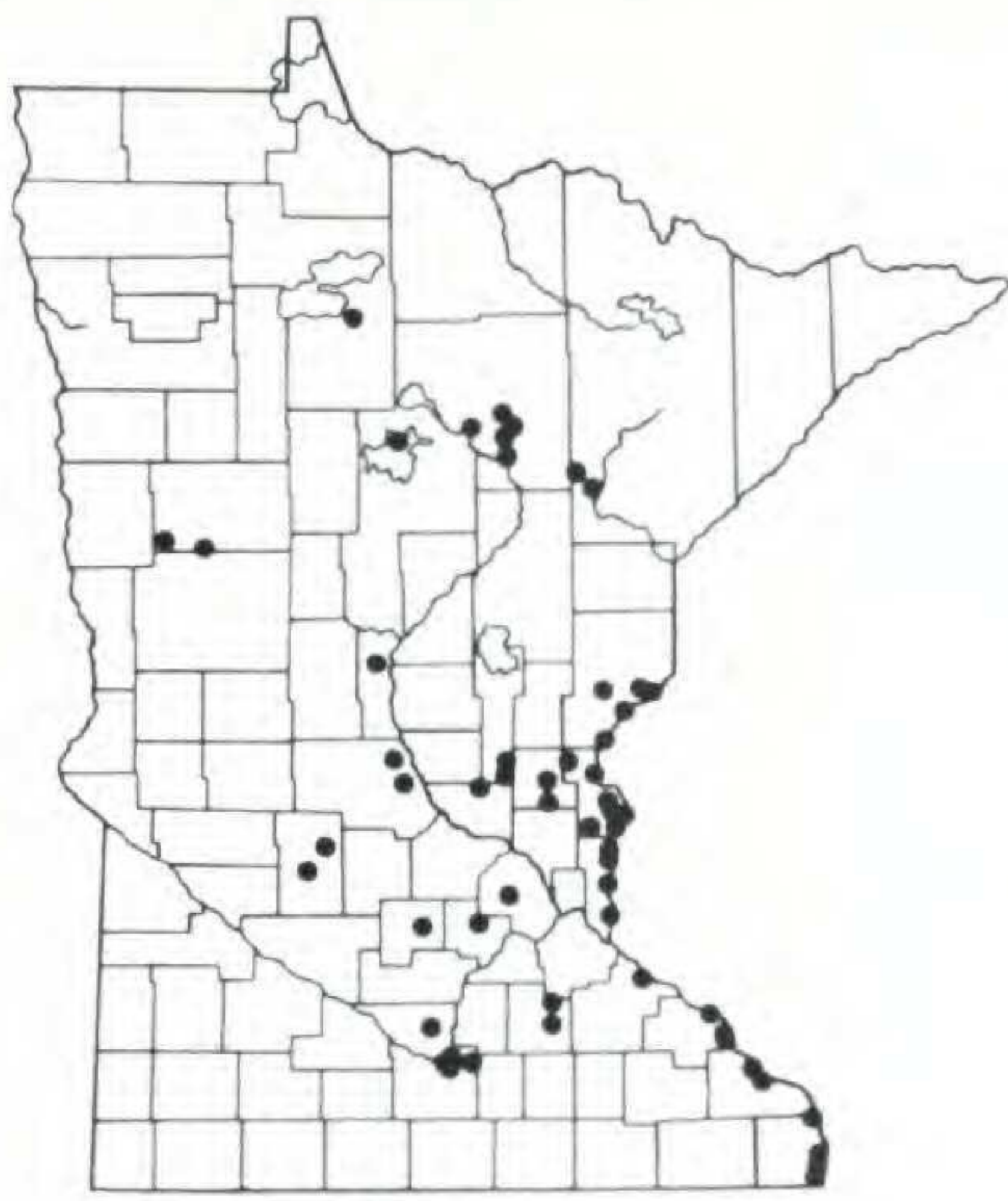
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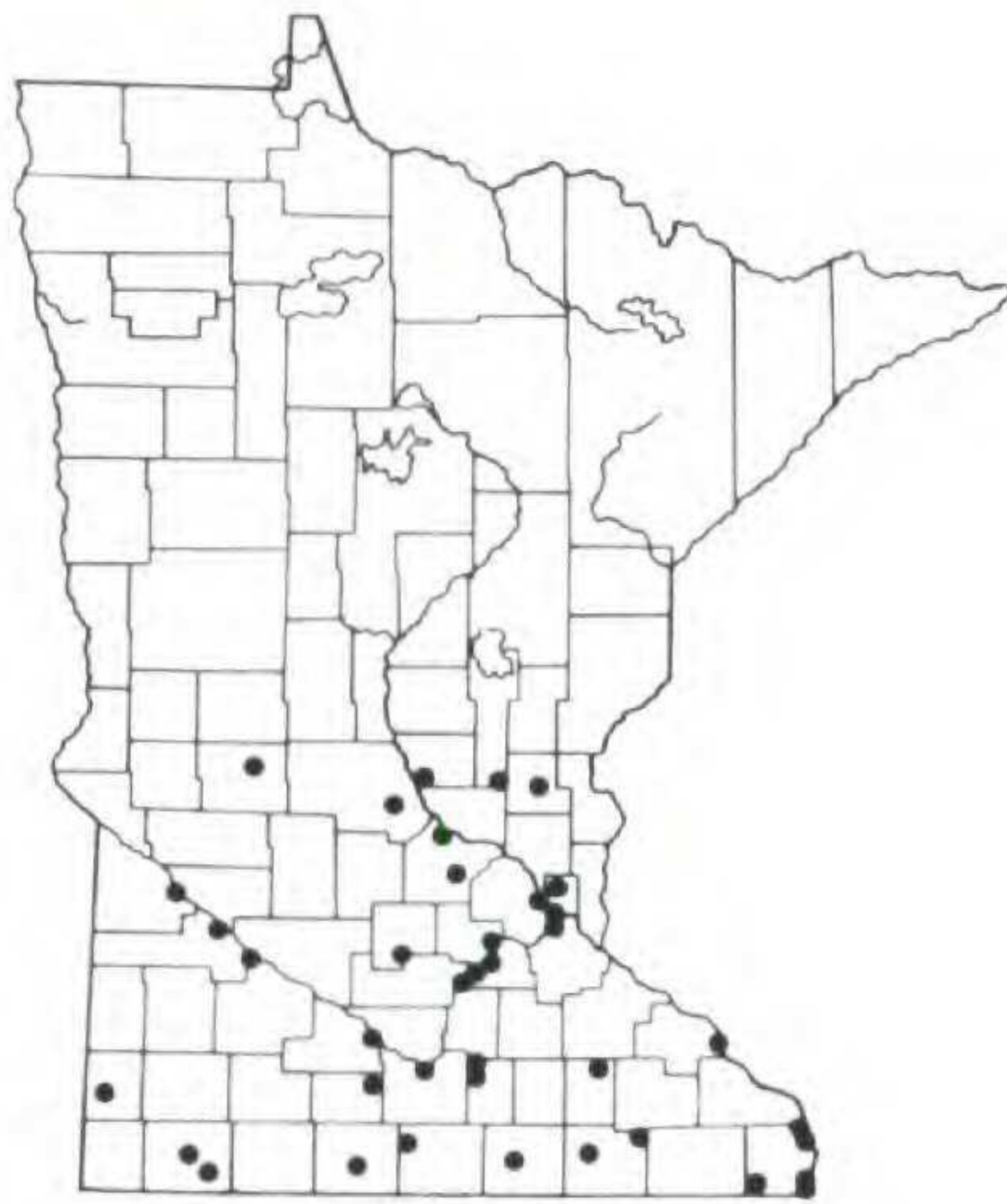
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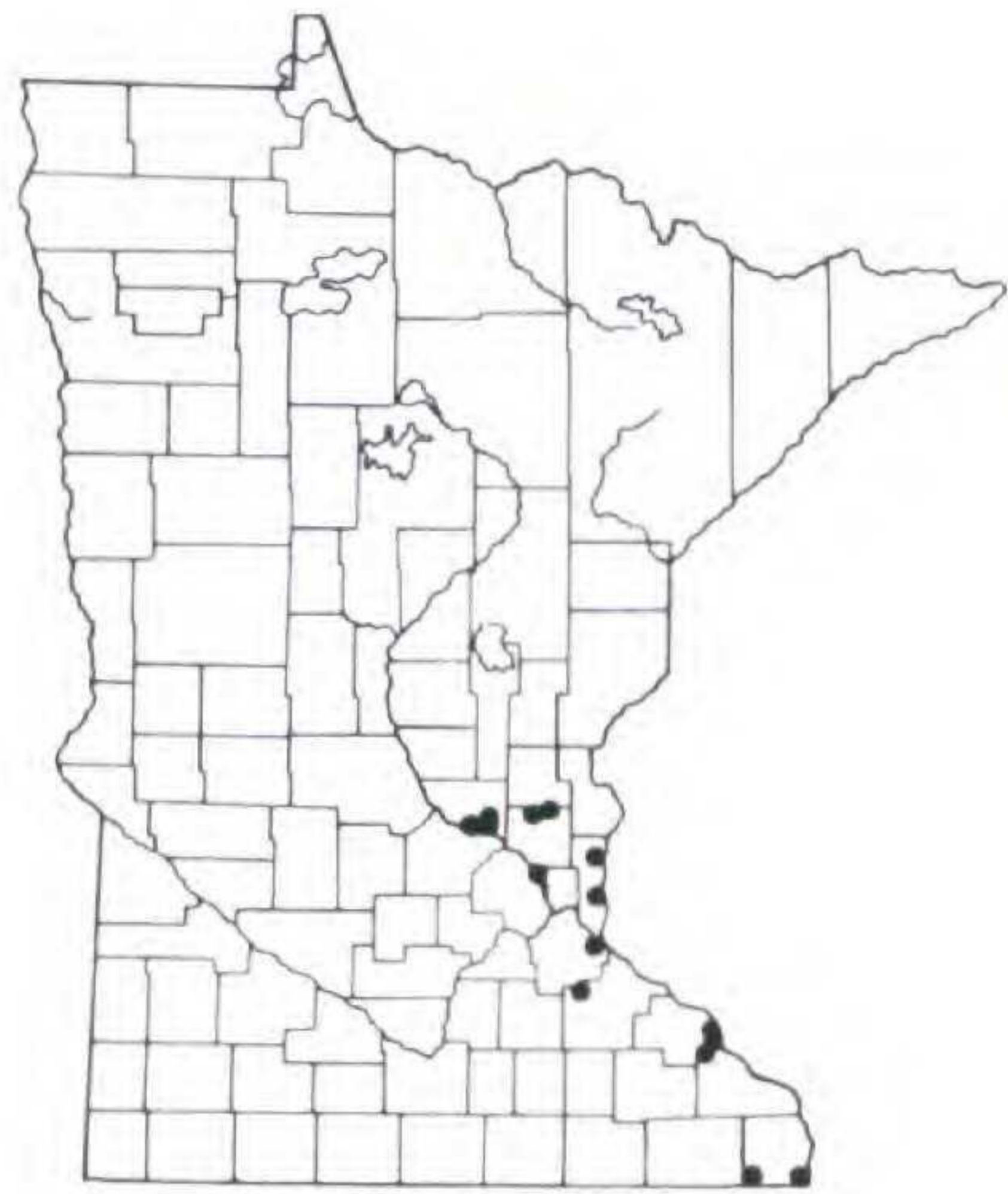
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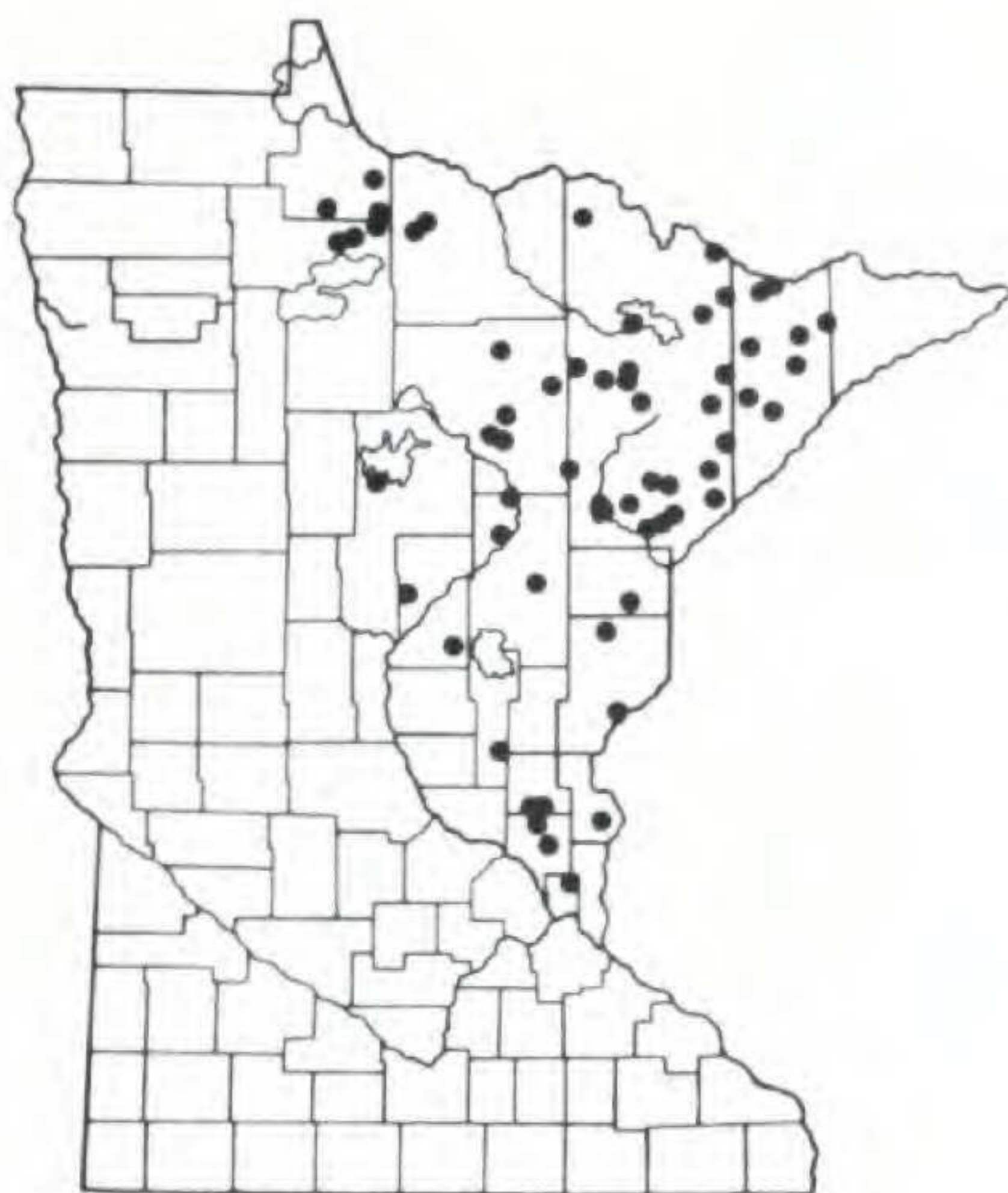
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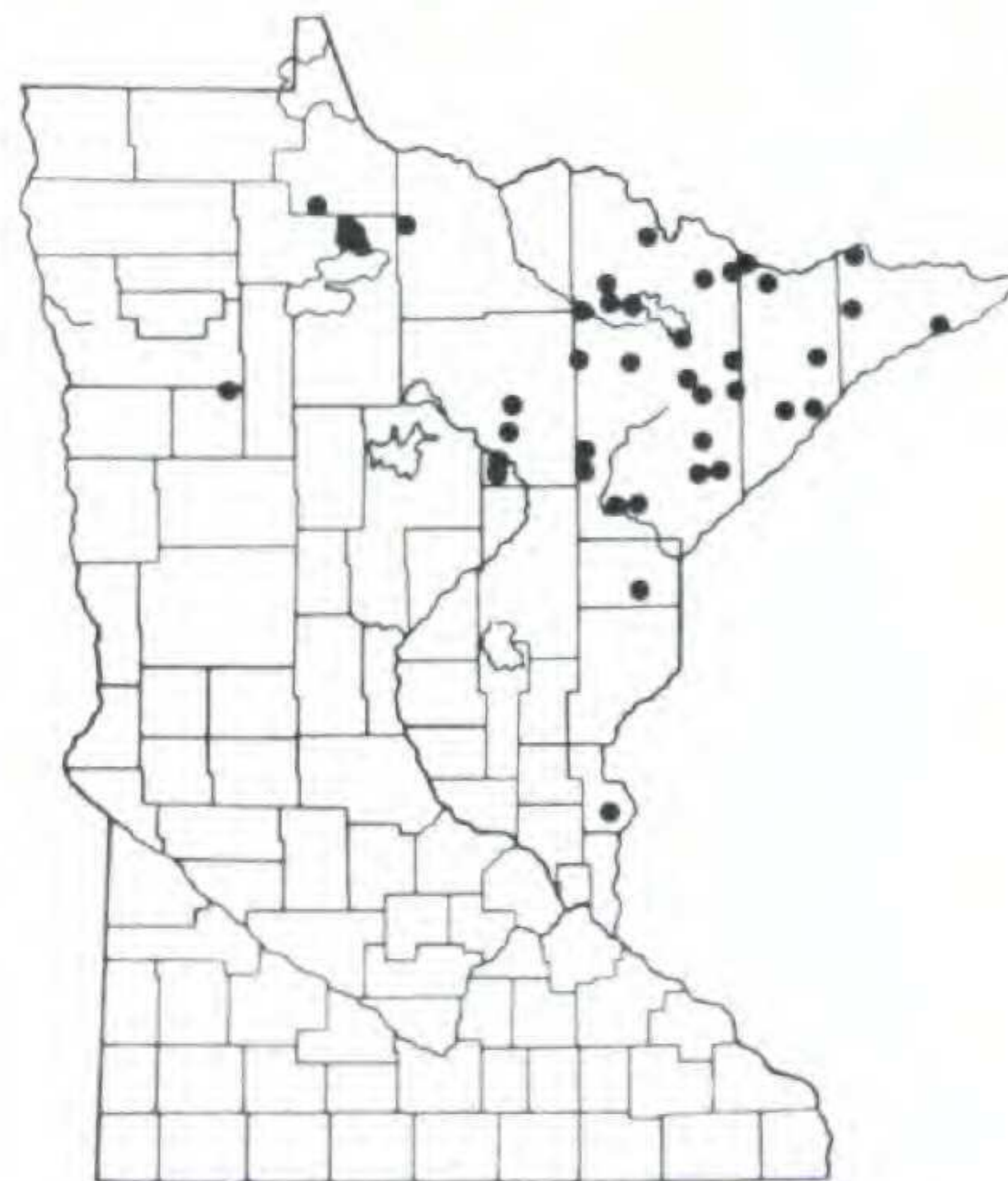
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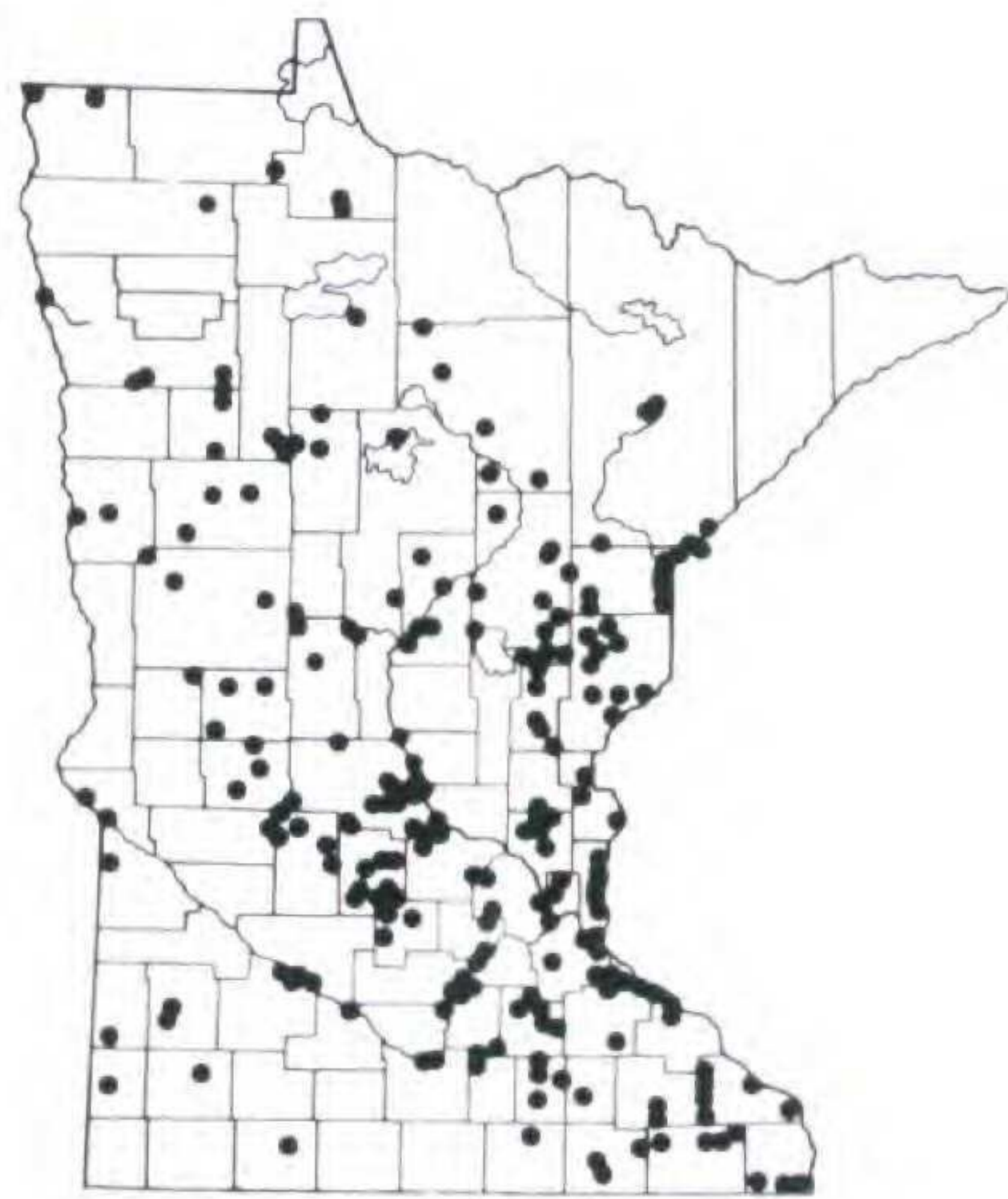
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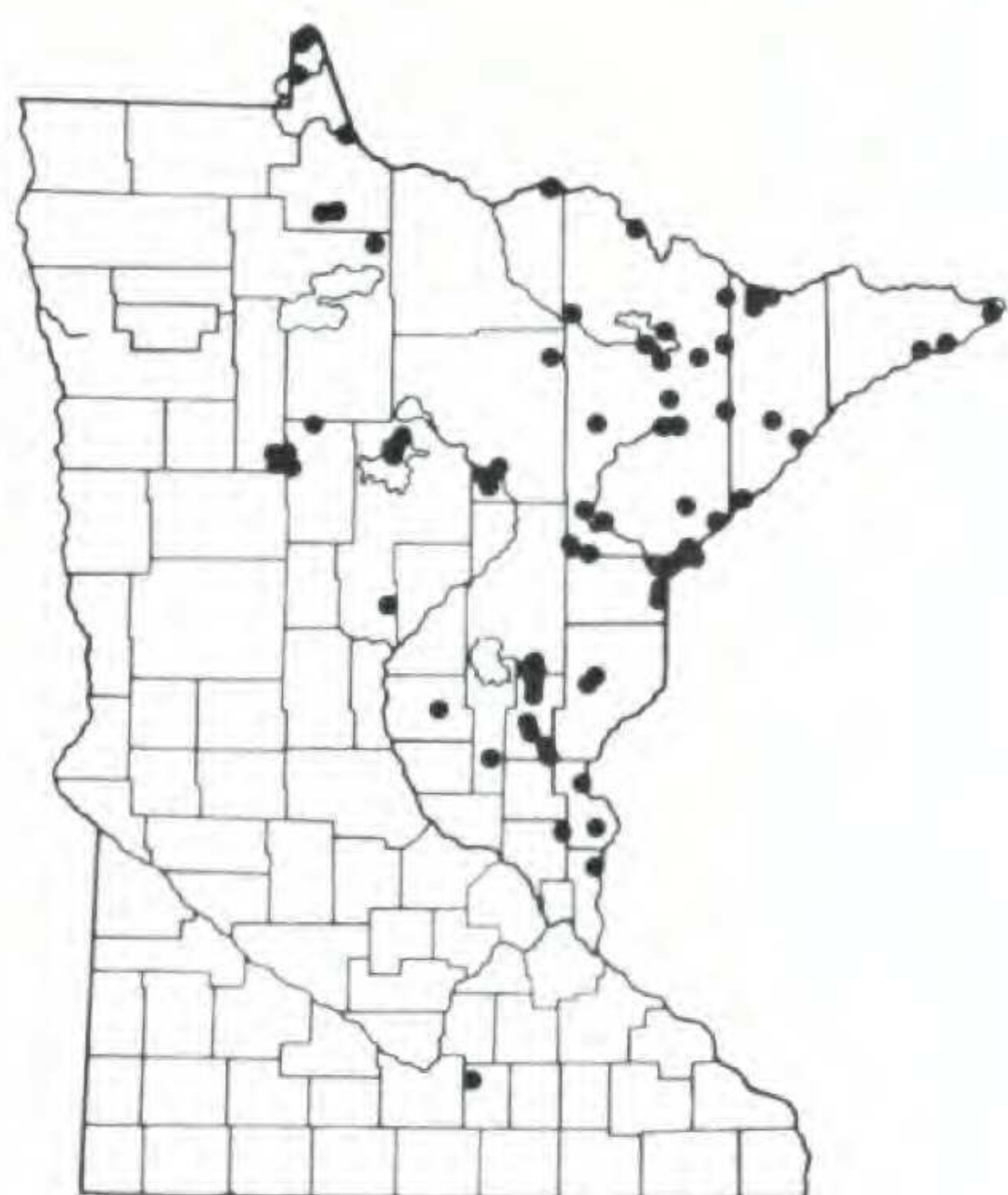
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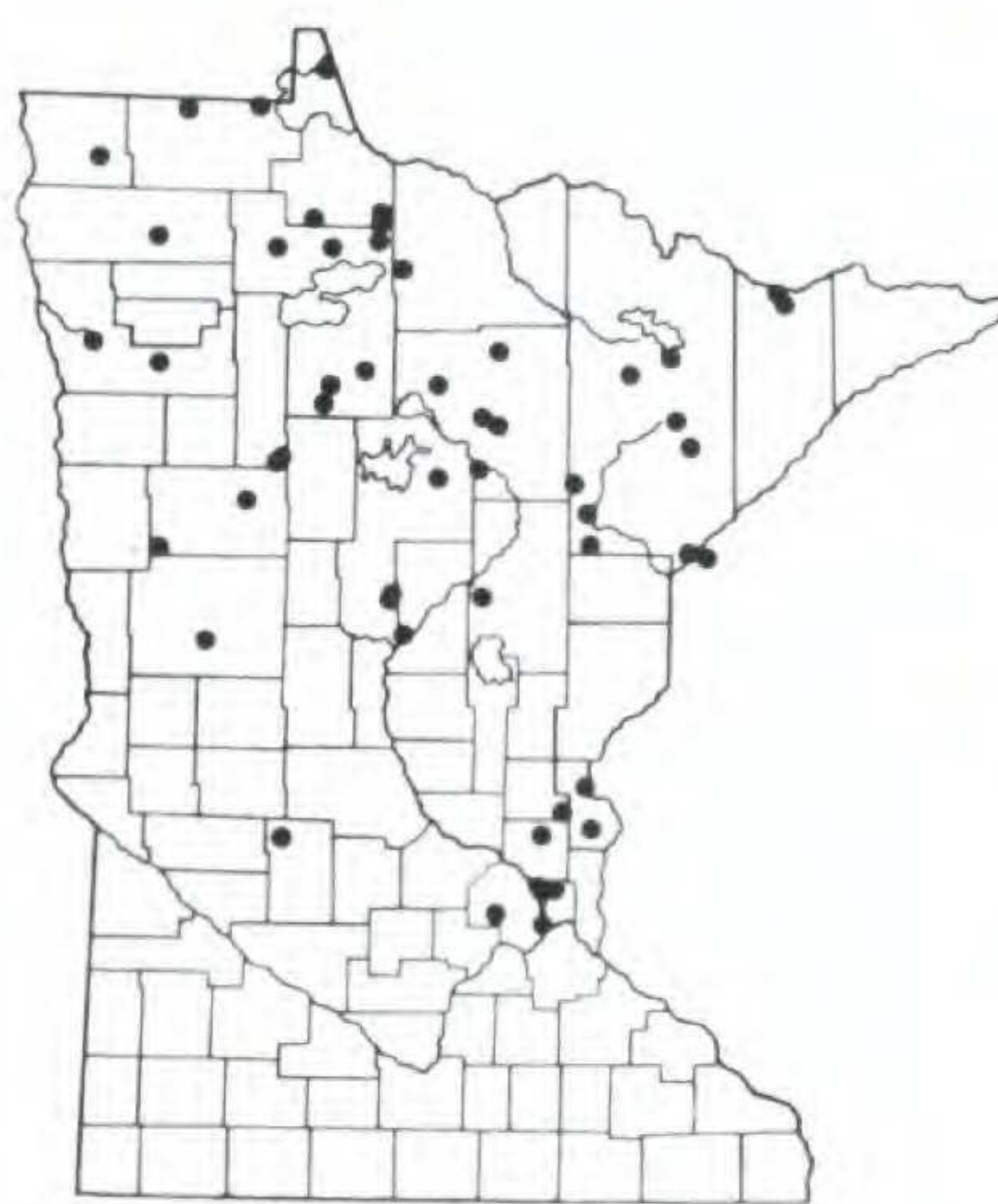
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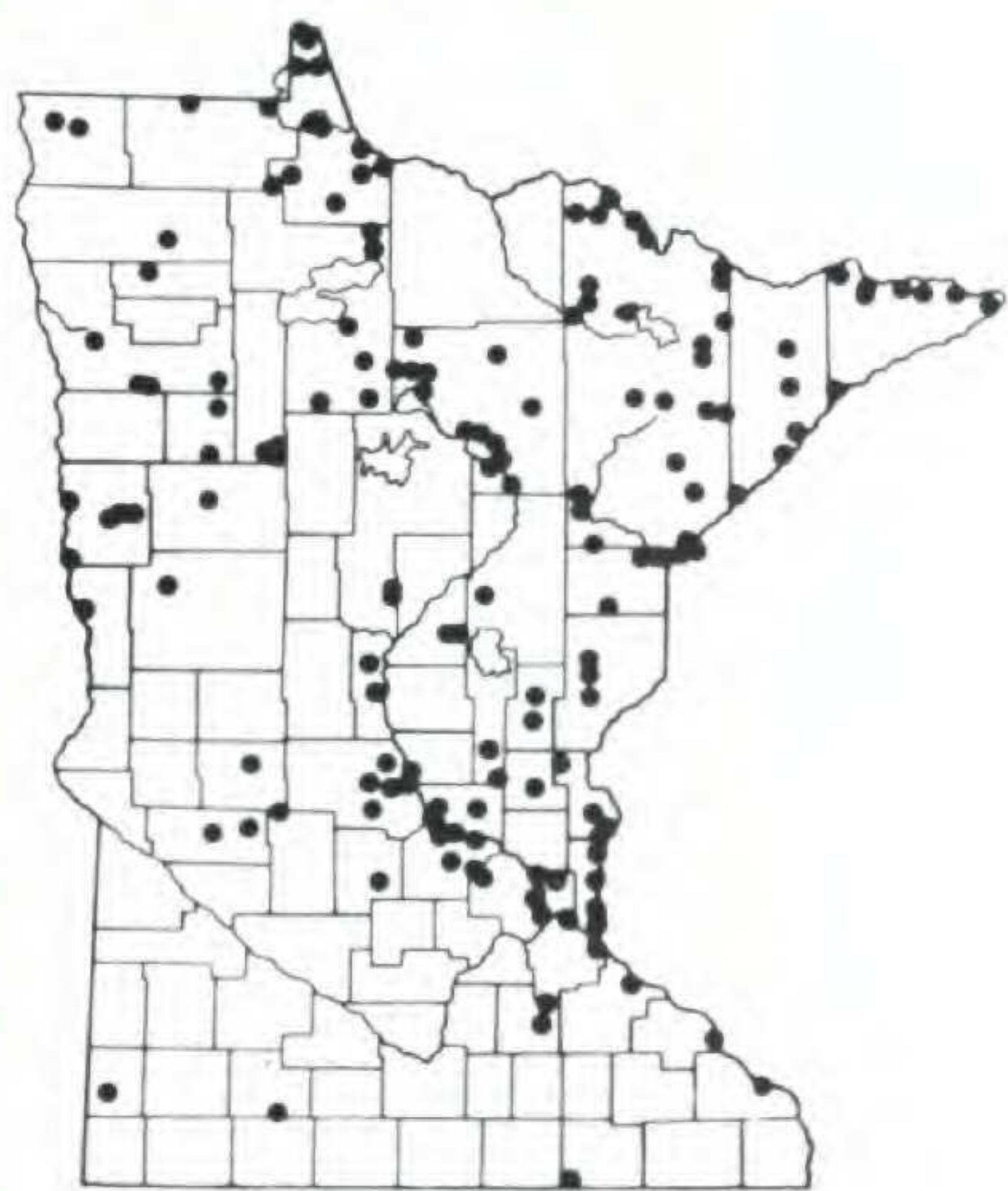
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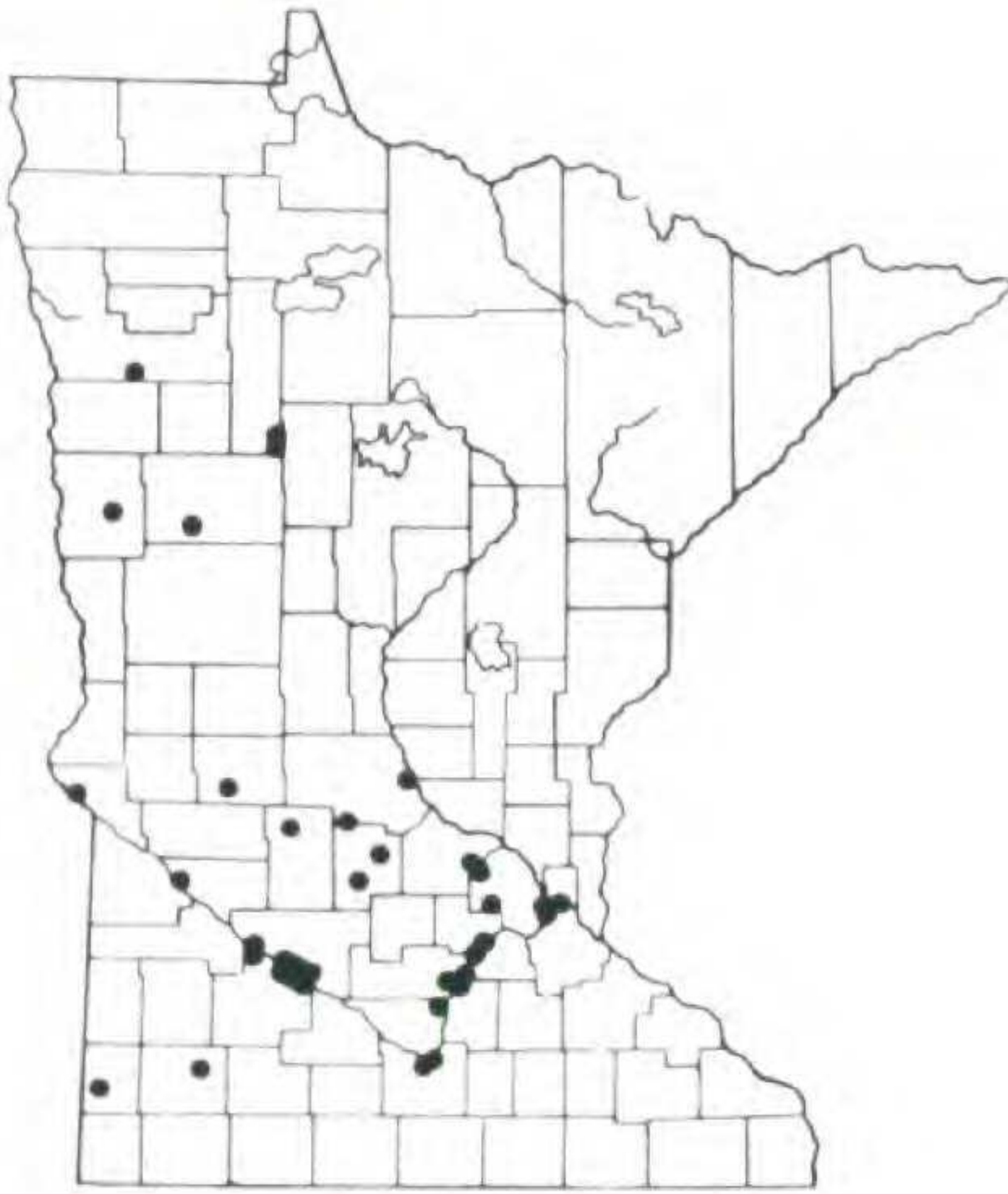
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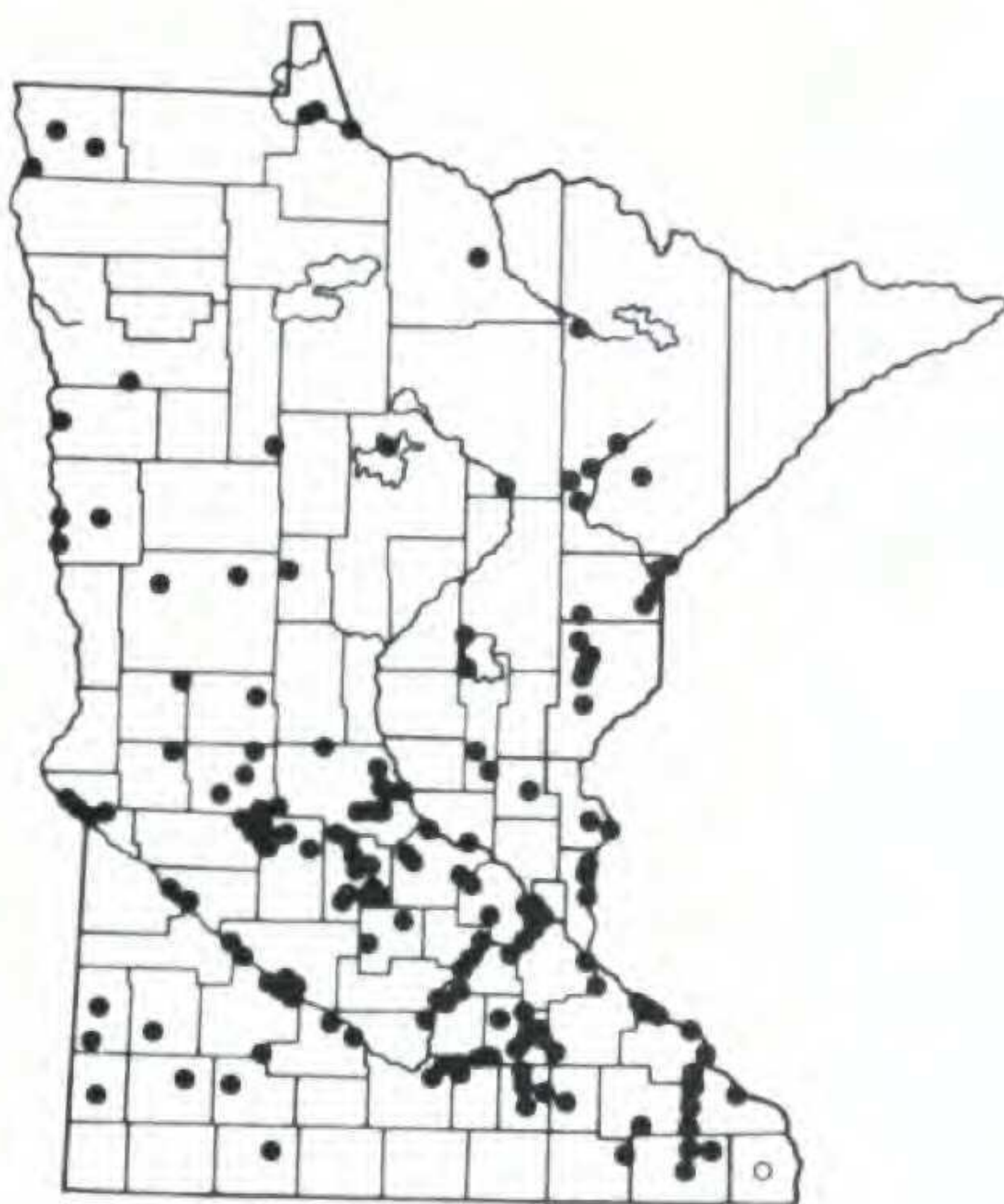
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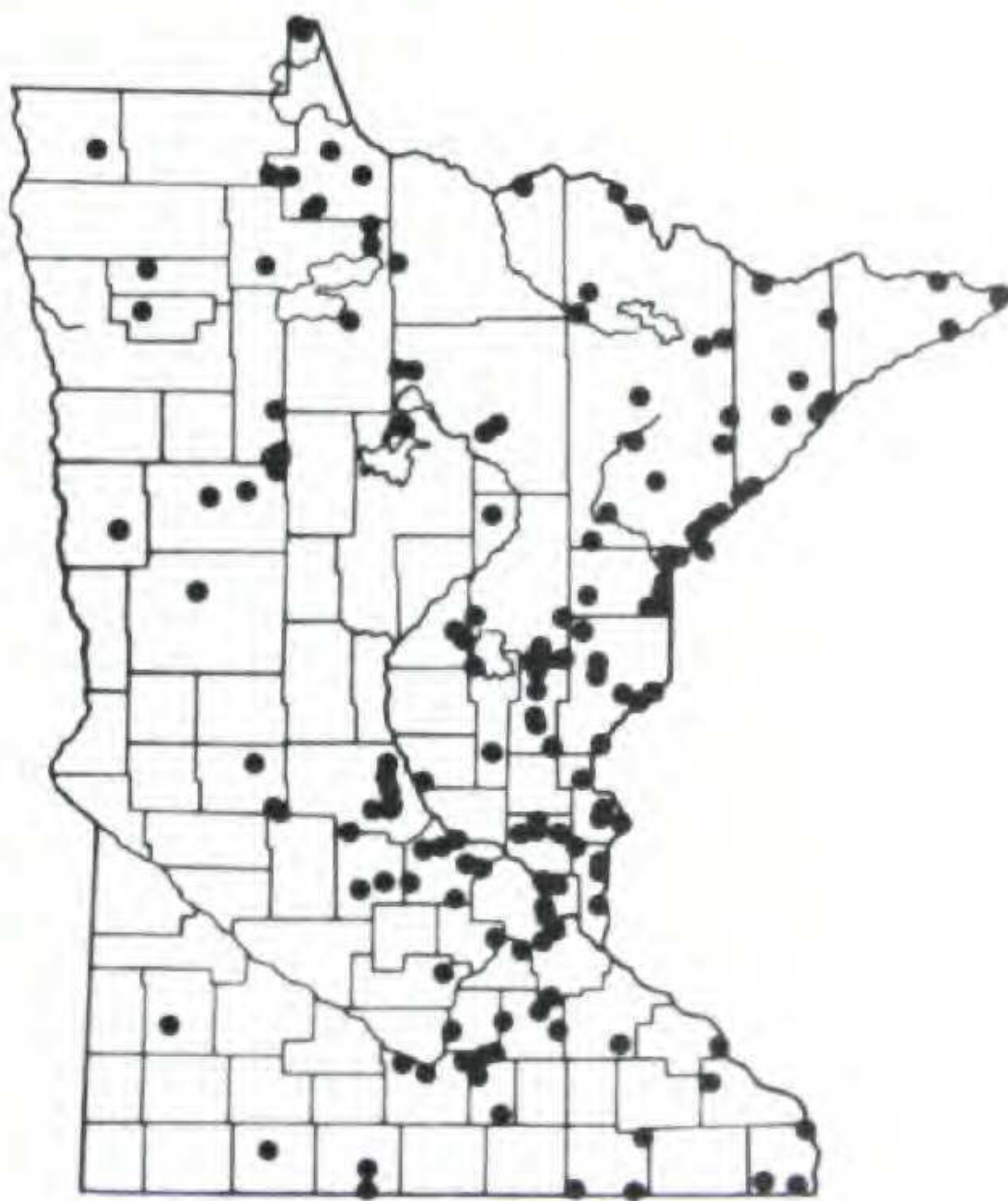
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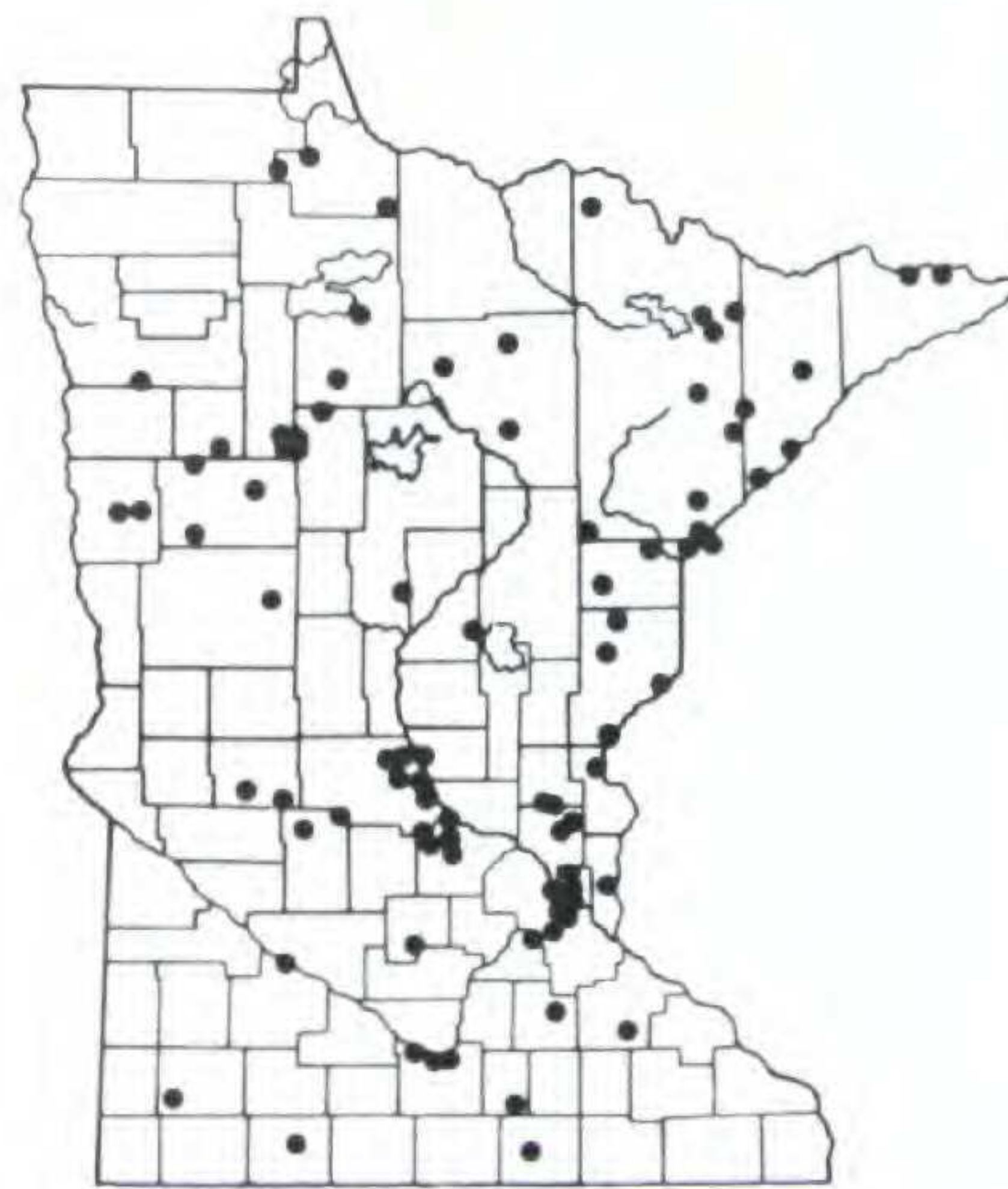
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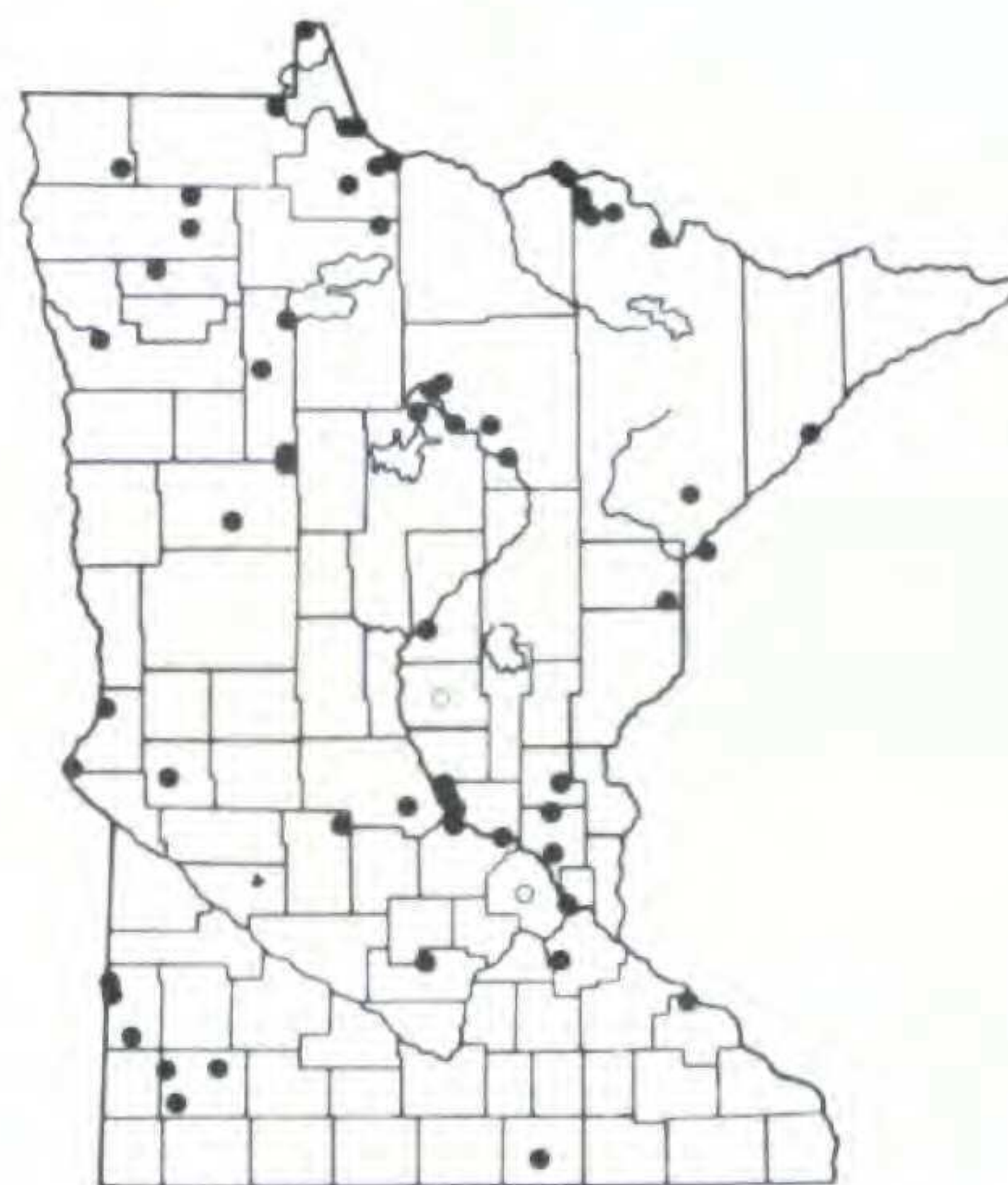
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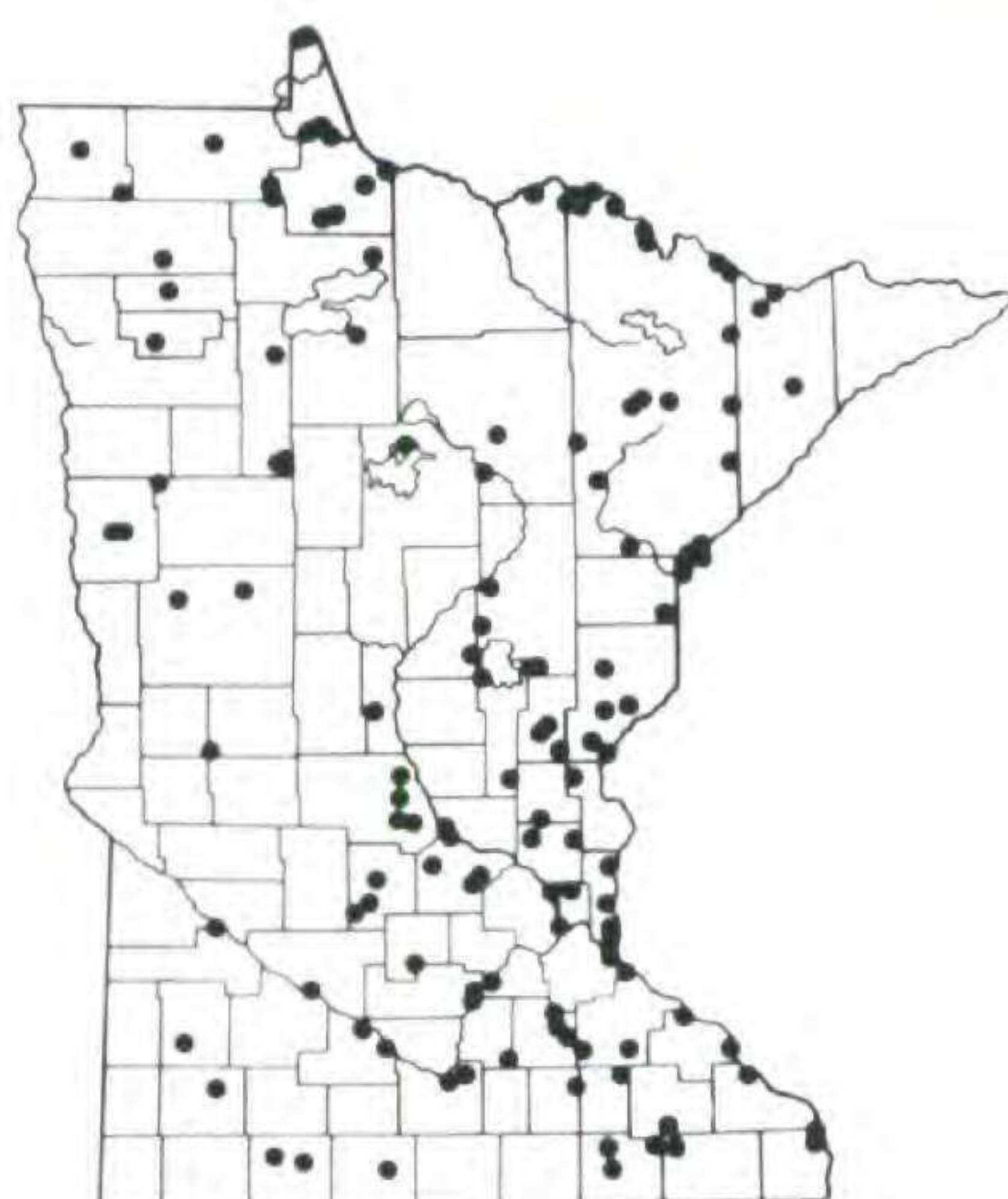
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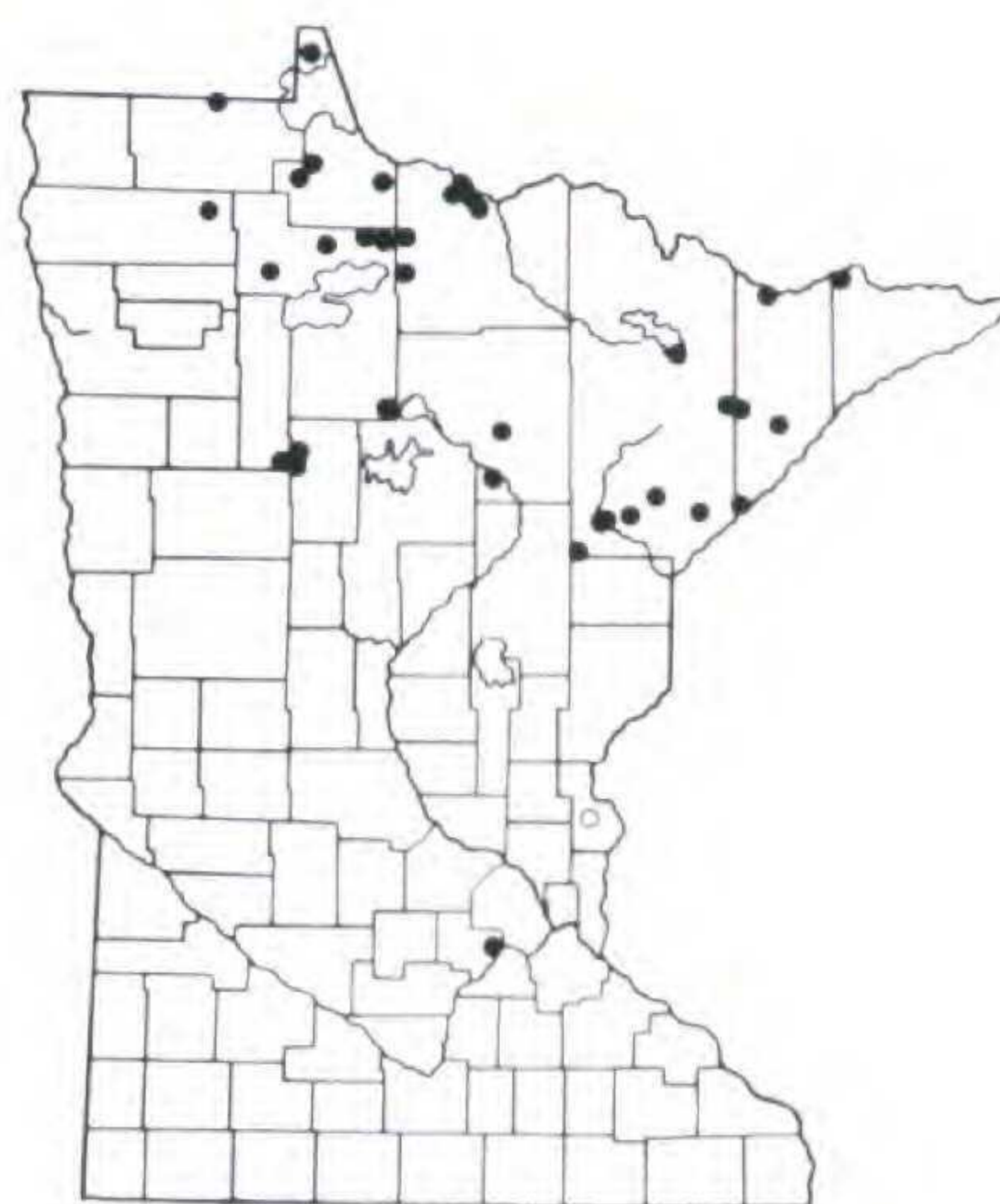
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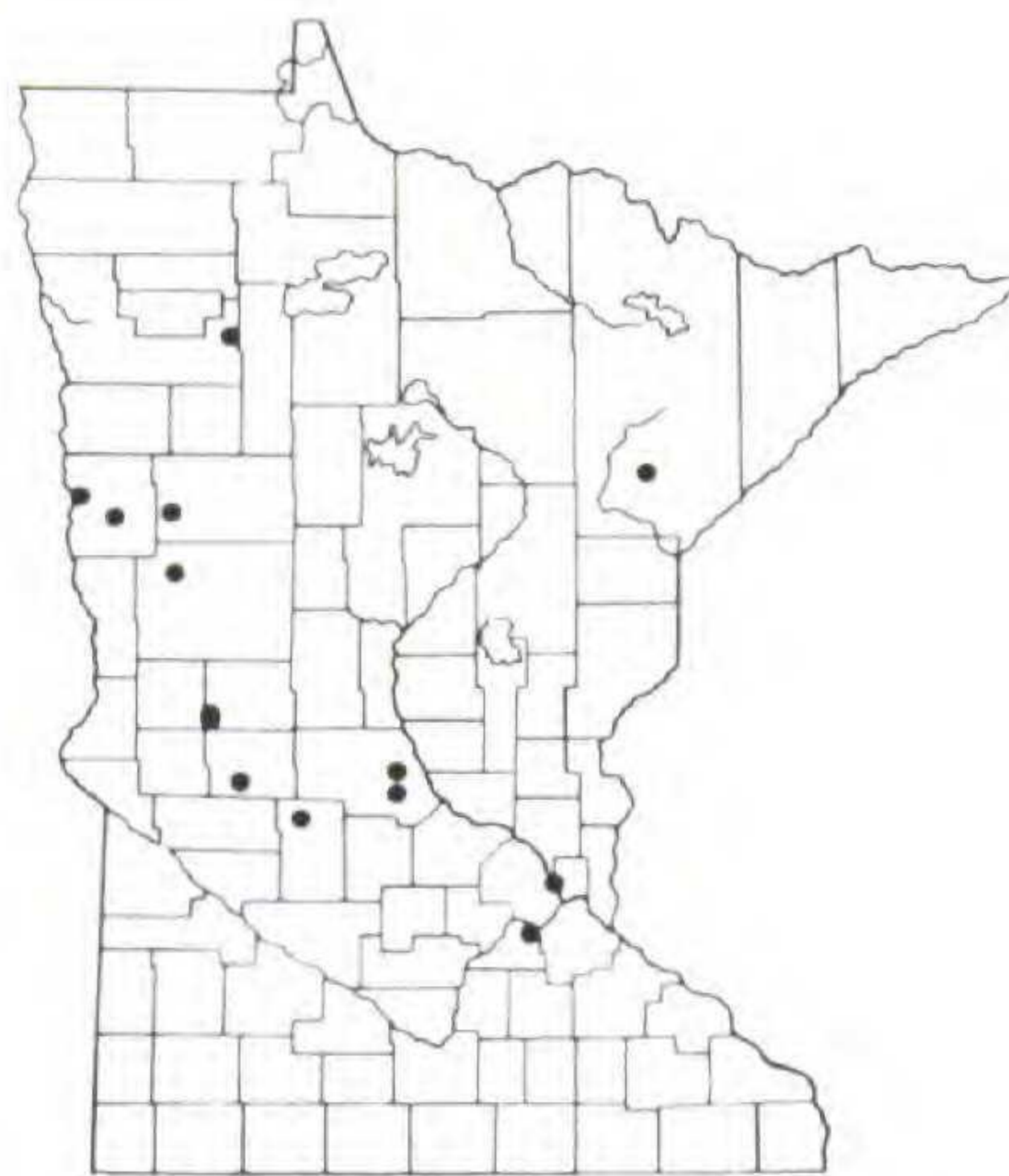
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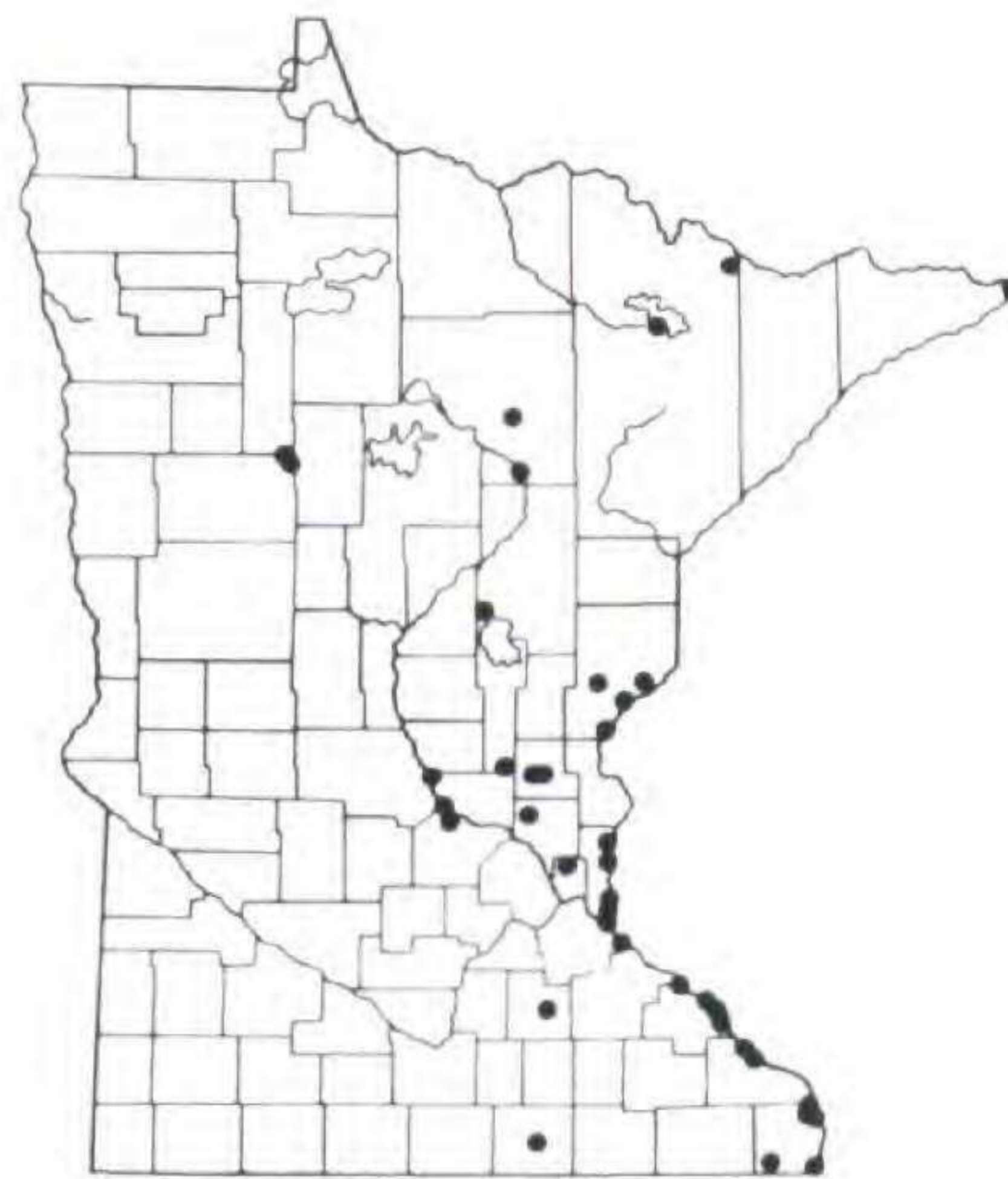
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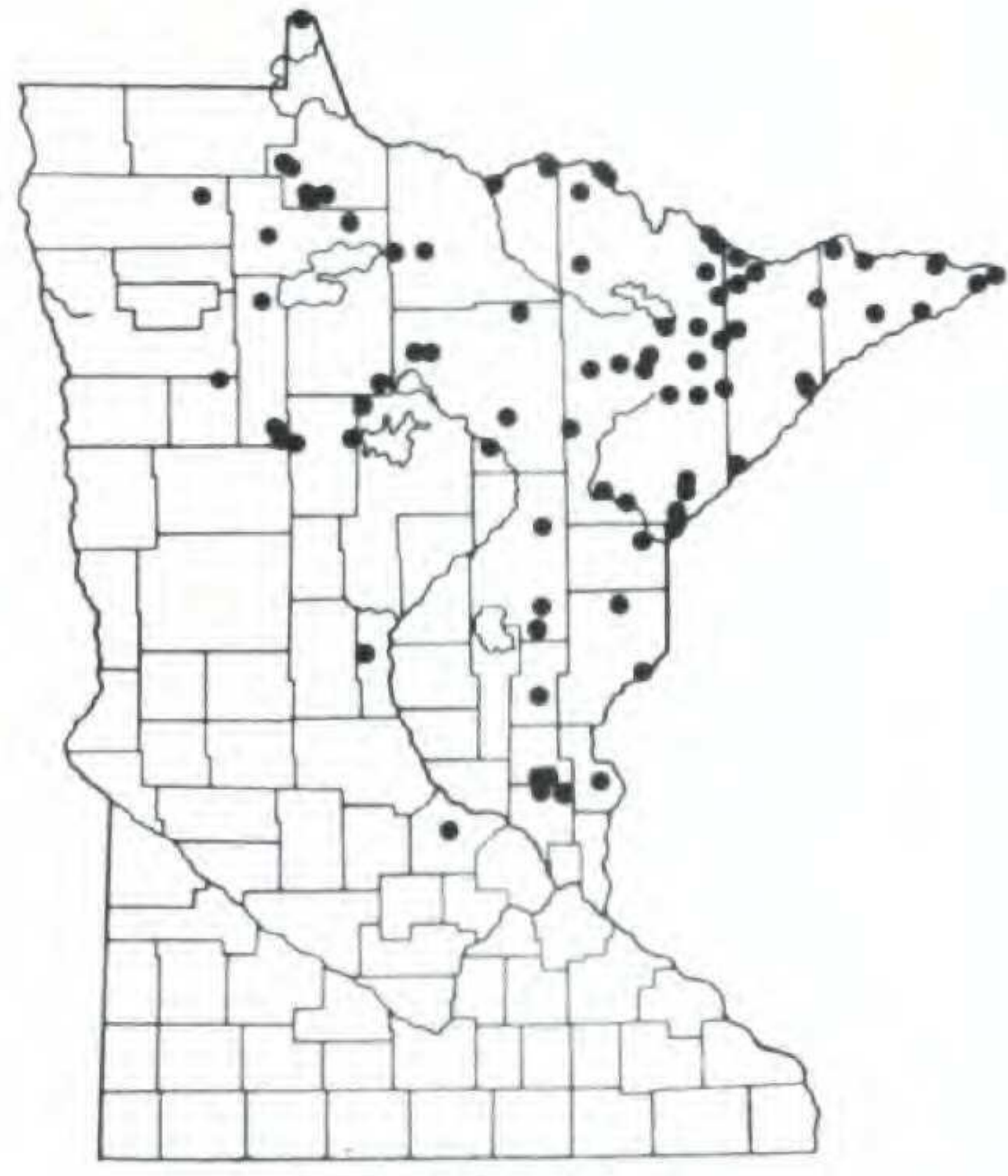
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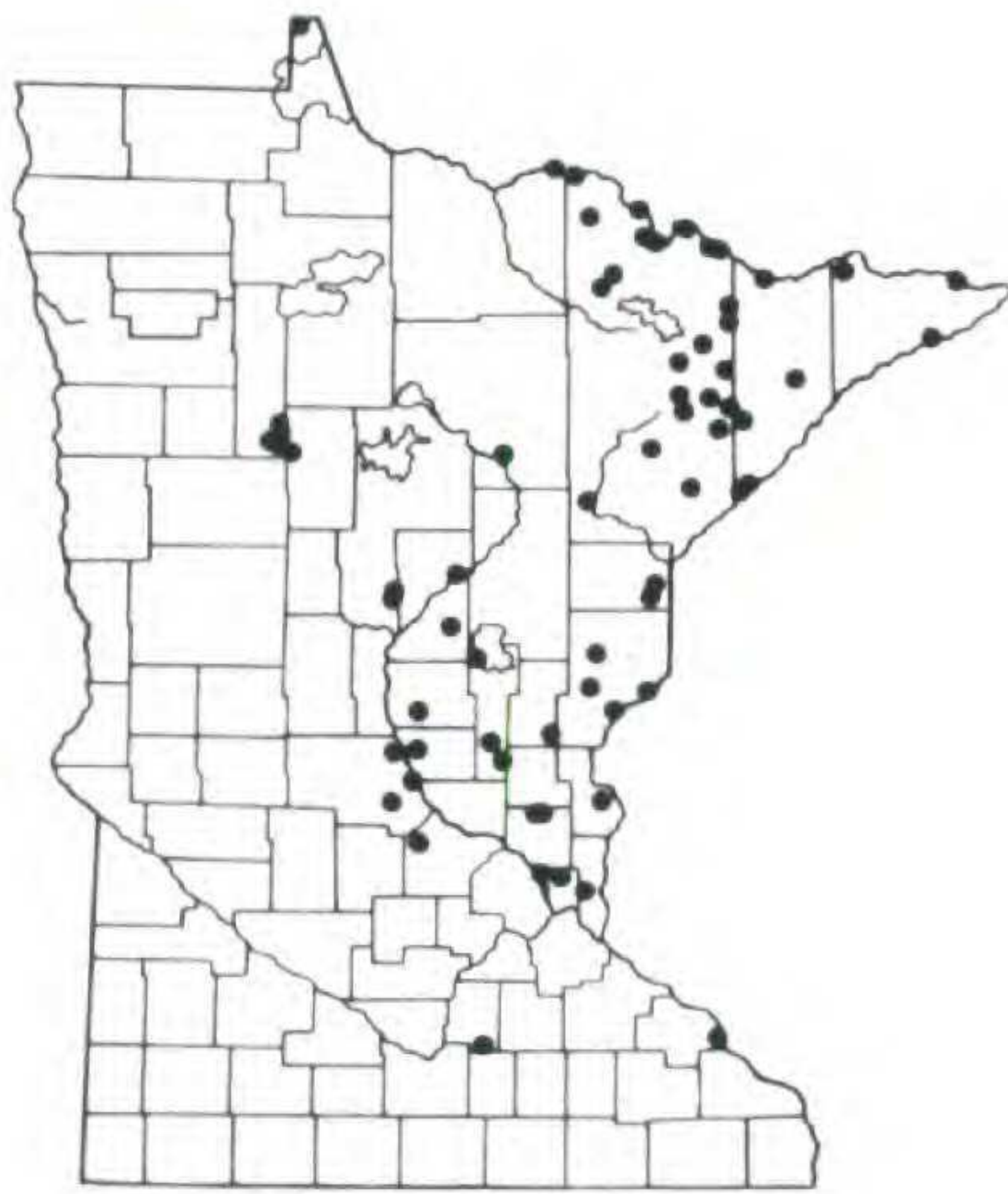
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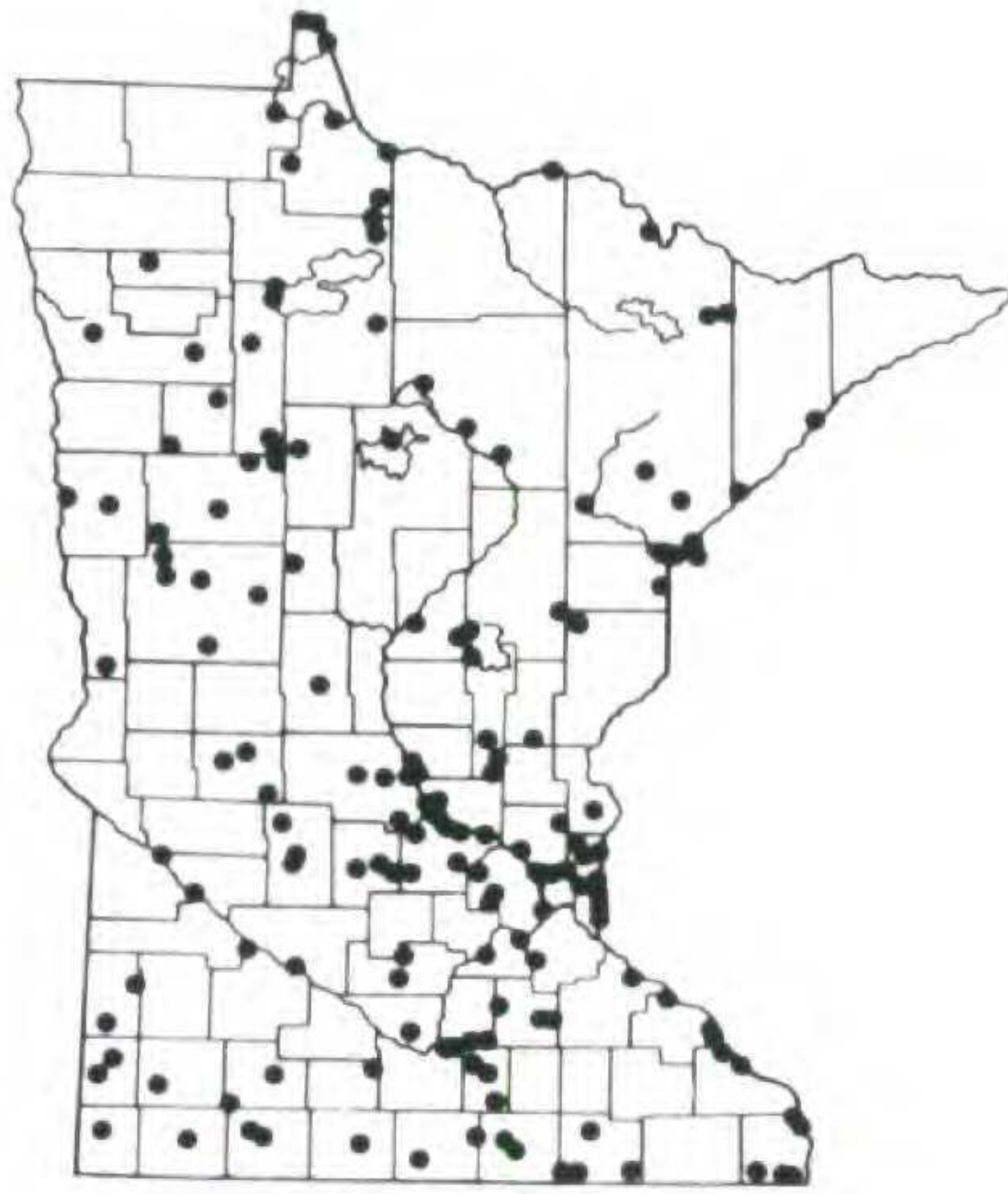
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CAREX VESICARIA



CAREX VIRIDULA



CAREX VULPINOIDEA



CAREX WOODII



CAREX XERANTICA

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